MFSA
MALTA
FINANCIAL
SERVICES
AUTHORITY

# Digital Transformation & FinTech Adoption:

## Within the Maltese Financial Services Sector

FinTech Supervision | Financial Stability

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# Contents

# List of Abbreviations

| | |
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| **AML** | Anti-Money Laundering |
| **API** | Application Programming Interface |
| **AI** | Artificial Intelligence |
| **AR** | Augmented Reality |
| **AP** | Authorised Person |
| **BIS** | Bank for International Settlements |
| **B2B** | Business-to-Business |
| **B2C** | Business-to-Consumers |
| **CBDC** | Central Bank Digital Currency |
| **CTF** | Counter Terrorist Financing |
| **DBS** | Digital Identity, Biometrics, and Sensors |
| **DeFi** | Decentralised Finance |
| **DTS** | Digital Transformation Strategy |
| **DLT** | Distributed Ledger Technology |
| **EBA** | European Banking Authority |
| **ESM** | European Single Market |
| **FSB** | Financial Stability Board |
| **FAS** | FinTech Adoption Study |
| **Function** | FinTech Supervision function |
| **FTE** | Full-Time Employment |
| **GIS** | Geographic Information System |
| **ICT** | Information Communication Technology |
| **IT** | Information Technology |
| **IaaS** | Infrastructure as a Service |
| **ML** | Machine Learning |
| **MFSA** | Malta Financial Services Authority or 'Authority' |
| **NIST** | National Institute of Standards and Technology |
| **NLP** | Natural Language Processing |

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| **NFT** | Non-Fungible Tokens |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PaaS** | Platform as a Service |
| **PCC** | Protected Cell Companies |
| **Rule** | Regulatory Sandbox Rule 3 |
| **RegTech** | Regulatory Technology |
| **RPA** | Robotic Process Automation |
| **SaaS** | Software as a Service |
| **SupTech** | Supervisory Technology |
| **VFA** | Virtual Financial Assets |
| **VR** | Virtual Reality |
| **WfMS** | Workflow Management Systems |

# List of Definitions

*The definitions provided below are of a general nature and are intended solely for informational purposes and to be used solely within the context of this Study.*

| | |
|---|---|
| **Active AP** | An AP that took direct or indirect actions towards digitisation, digitalisation, or implementation of enabling technologies and innovations. |
| **API** | A programmed code that governs access points and allows two different applications, systems, or software to communicate with each other, using a set of common standards. Further information on APIs is available in the FinSight here. |
| **AI and ML** | AI refers to an application of computerised tools that perform tasks which require human sophistication, and ML is a branch of AI which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Further information on AI is available in the FinSight here. |
| **AR and VR** | AR augments surroundings by adding digital elements to a live view, often by using the camera on a smartphone. VR is a completely immersive experience that replaces a real-life environment with a simulated one. |
| **Big Data and Data Analytics** | Refers to the application of various techniques, such as AI, to store and analyse large sets of complex data. |
| **Cloud Computing** | Refers to a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Further information on cloud computing is available in the FinSight here. |
| **Credit Risk** | The risk that potentially a bank borrower or counterparty in general will fail to meet its obligations in accordance with agreed terms. |
| **Cyber Risk** | Refers to the combination of the probability and impact of cyber incidents. |
| **DBS** | Digital identity refers to the evidence that identifies a person when accessing online services, carrying out transactions or an operation that requires proof of identity. Biometrics refers to means of identifying and authenticating individuals through unique |

| | |
|---|---|
| | biological characteristics, while sensors refer to devices that produce an output signal for the purpose of sensing a physical phenomenon. |
| **DeFi** | Refers to an emerging form of decentralised and autonomous financial services powered by smart contracts, facilitating unrestricted access to the disintermediated financial services akin to the traditional financial system on a quasi-anonymous basis. Further information on DeFi is available in the FinSight here. |
| **Digitisation** | The process of converting information into a digital format. |
| **Digitalisation** | Actions taken beyond digitisation through the leveraging of digital information technology to entirely transform a business process. |
| **Digital Platform** | Refers to a technology-enabled business model that creates value by facilitating exchanges between producers and consumers on one digital platform. |
| **DTS** | Refers to any direct/indirect action/s taken by the AP towards digitisation, digitalisation and/or implementation of enabling technology/ies and innovations. |
| **DLT** | A database system in which information is recorded, consensually shared, and synchronised across a network of multiple nodes. Further information on DLT is available in the FinSight here. |
| **FinTech** | Technologically-enabled financial innovation that could result in new business models, applications, processes or products with an associated material effect on financial markets and the provision of financial services. |
| **FinTech Service Provider** | Refers to a person who is duly licensed or otherwise authorised to provide or who intends to provide a service/s requiring a licence or other authorisation in terms of applicable financial services legislation currently in force in Malta and who utilises FinTech in its operations. |
| **FTE** | A ratio that measures the number of employed individuals or students, making them comparable given their different characteristics. |
| **GIS** | Refers to systems that include databases containing geographic data, combined with software tools for managing, analysing, and visualizing such data. |

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| **Leverage Risk** | Leverage is the use of debt (borrowed capital) to undertake an investment or project. At the same time, leverage will also multiply the potential downside risk in case the investment does not pan out. When one refers to a company, property, or investment as "highly leveraged," it means that item has more debt than equity. |
| **Liquidity Risk** | The ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses. |
| **Market Risk** | The risk of losses arising from movements in market prices. The risks subject to market risk capital requirements include but are not limited to default risk, interest rate risk, credit spread risk, equity risk, foreign exchange risk and commodities risk for trading book instruments. |
| **NLP** | A branch of computer science and AI which focuses on providing computers the ability to understand text and spoken words. |
| **NFT** | Refers to tokens that represent ownership of unique physical or digital items. |
| **Operational Risk** | Refers to the risk of loss resulting from inadequate or failed internal processes, stakeholders or external events. |
| **Passive AP** | Refers to an AP that did not take any action towards digitisation, digitalisation, or implementation towards enabling technologies and innovation. |
| **Quantum Computing** | Refers to technology that applies the laws of quantum mechanics to solve complex problems. |
| **RegTech** | Incorporates any range of applications of technology-enabled innovation for regulatory, compliance and reporting requirements implemented by a regulated institution. |
| **Reputational Risk** | Refers to the possibility of negative publicity regarding a firm irrespective of whether it is true or not. |
| **RPA** | Refers to technologies that copy the way humans interact with software to perform high-volume, repeatable tasks. |
| **Smart Contracts** | Refers to the digitisation of agreements by turning the terms of an agreement into computer code that automatically executes when the contract terms are met. Further information on smart contracts can be found here, including its legal implications. |

**SupTech** Refers to the application of innovative technology by financial authorities to support their work.

**WfMS** An infrastructure for the set-up, performance and monitoring of a defined sequence of tasks, organised as a workflow application, the latter being a software that to some degree automates a number of processes.

# 1  Executive Summary

In line with the mandate set out in the 2019 MFSA's FinTech Strategy, the FAS provides an in-depth understanding and analysis on the adoption of FinTech, its market conditions, and their consequent externalities. First of its kind, the FAS attempts to understand the FinTech ecosystem locally and sets a benchmark for the adoption of innovative and enabling technology within the Maltese Financial Services sector for the reference year of 2021. However, the results of the FAS do not include responses from technology providers. Data was collected via the distribution of an online Questionnaire to APs based on their authorisation sectors, covering key areas within the local financial services landscape most likely to adopt innovative or enabling technologies. A response rate of 95 per cent was attained, covering in total 390 APs and 472 authorisations.

Slightly more than half of surveyed APs have taken actions towards digitisation, digitalisation or implementation of enabling or innovative technologies, which were mainly adopted before 2020. From those with a DTS, the majority take the form of mixed strategies which were not updated regularly and have a time horizon of more than three years. Most APs utilise RegTech solutions across their DTSs, with AML and CTF, and operational resilience being identified as the main areas. Only a small portion of APs are expected to qualify as FinTech Service Providers beyond 2022, with the majority not qualifying at all during the time of study. Although APs identified that digital transformation would have an impact on their business model viability going forward, more than half of APs with no DTS in place still do not consider taking actions towards digitisation, digitalisation, or implementation of enabling or innovative technologies in the future.

The top three most significant objectives for APs towards the development and implementation of DTSs were for the purposes of efficiency, enhanced customer experience and engagement, and reduction of operational risks associated with information and cyber security. Equivalently, the top three objectives which resulted in the highest benefits for APs towards the adoption of their DTSs were enhanced efficiencies, reduction of money laundering and terrorist financing risks, and enhanced customer experience and engagement. For APs to finance their DTSs, own funding was the preferred method, with the majority making use of third-party providers to adopt their DTSs. Also, most APs allocated less than 25% of their internal FTE workforce, IT budget, and DTS budget towards the adoption of their DTSs.

Taking into consideration the DTSs in place across all surveyed APs, the main three enabling and innovative technologies adopted within the local financial services landscape were cloud computing, API, and web and mobile applications. Cloud computing was mostly adopted across Insurance Intermediaries, APIs across Financial Institutions, and web and mobile applications across Investment Funds. For the key enabling and innovative technologies, the FAS also includes their applications, adoption stage, deployment time, ownership of technological solutions, and for cloud computing the type of deployment models used.

The FAS also presents the main applications per enabling technology. In terms of DLT, the five most popular applications were in the areas of payment solutions, clearing and settlement, crypto payments, DeFi applications, and data gathering, storage and documentation, with the top three applications being fully developed and owned by the APs. From APs that adopt DLT in their DTSs, more than half already utilise or provide DLT-based solutions for payment purposes. In 2021, half of APs had already adopted solutions for clearing and settlement, and data collection, storage and documentation. The DLT-based applications mostly expected deployment in 2022 are the issuance of crypto-assets for payment purposes, DeFi applications, and payment solutions.

Chatbots and virtual assistants, cybercrime, AML, operational efficiency, and fraud detection were the five most popular AI and ML applications, which were mainly either fully bought from or used via partnership with third-party providers. Most APs with chatbots and virtual assistants in their DTSs already adopted the technology. In 2021, a substantial number of APs had already deployed solutions for cybercrime detection and prevention. In the area of AI and ML, the applications mostly expected deployment are for operation efficiency in 2022, AML prevention and detection in 2023, and chatbots and virtual assistants in 2024.

Regulatory compliance, fraud and risk reduction, payment services, account information services, facilitation of other services provided by APs, and provision of an interface to connect customers and service providers were the five most popular applications of APIs, with a mix on the ownership of technological solutions, whether developed internally or obtained from third-party providers. A substantial number of APs with APIs in their DTSs already adopt the technology for regulatory compliance, fraud, and risk reduction. In 2021 most APs had already deployed solutions for account information related services. The API applications mostly expected deployment are in regulatory compliance, fraud and risk reduction in 2022, payment related services in 2023, and the provision of an interface to connect customers and service providers in 2024.

Digital signatures, face biometrics, fingerprint biometrics, self-sovereign identity, and temperature sensors were the top five DBS applications, which were mainly either fully bought from or used via partnership with third-party providers. Most APs with digital identities in their DTSs already adopted digital signatures. In 2021, a substantial number of APs had already deployed fingerprint or palmprint biometrics. The digital identity application mostly expected deployment is self-sovereign identities in 2022, and digital signatures in 2023.

The five most popular cloud computing applications were SaaS, PaaS and IaaS for internal purposes, and SaaS for B2B and SaaS for B2C, which were mainly either fully bought from or used via partnership with third-party providers. From APs that adopted cloud computing in their DTSs, the majority already utilised SaaS for internal purposes, and were mostly already deployed in 2021. The cloud computing applications mostly expected deployment are PaaS in 2022, SaaS for B2B and PaaS in 2023, and IaaS and PaaS in 2024. The deployment models of the top five cloud computing applications mainly consist of public and private cloud.

Web and mobile applications, WfMS, big data and data analytics, digital platforms, and RPA were the top five other enabling technological applications, with a mix on the ownership of

technological solutions, whether developed internally or obtained from third-party providers. From APs that adopted web and mobile applications in their DTSs, the majority already make use of such technology, and were mostly already deployed in 2021. The other enabling technologies mostly expected deployment are digital platforms in 2022, WfMS in 2023, and big data and data analytics in 2024.

To understand the local considerations and implications following the adoption of FinTech within the financial services sector, with respect to enabling and innovative technologies, the FAS covers the factors influencing its adoption, the impact on local aspects of financial services, and the overall financial services landscape, including the consequent risks on firms. Based on the entire surveyed population, the factor that mostly motivates the adoption of enabling and innovative technologies was access to the ESM, which was especially significant across VFA Service Providers. Consequently, APs believe that local political factors were considered as a challenge towards the adoption of enabling and innovative technologies, which were also mostly significant across VFA Service Providers. Additionally, data privacy frameworks and requirements were considered by APs as the top factor which does not influence them towards the adoption of enabling and innovative technologies, mostly present across financial institutions.

Based on the viewpoint of APs, the adoption of enabling and innovative technology extremely influences the areas of payment services, payment infrastructures, and commercial banking. Also, the positive impact of adopting enabling, and innovative technologies significantly outweigh the negative impact. The negative impact following the adoption of enabling and innovative technologies was negligible but mostly influencing the areas of reinsurance and insurance. Based on their opinion, APs note that the financial services landscape was extremely influenced following the adoption of cloud computing, APIs, and web and mobile applications. On the other hand, AR and VR were identified as the technology that mostly does not influence the financial services landscape. According to the opinion of APs, the overall effect on the financial services landscape following the adoption of enabling and innovative technologies were positive. In this regard, the adoption of cloud computing, big data and data analytics, and APIs had the highest positive effects on the financial services landscape. Conversely, according to the APs viewpoint, the highest negative effects were observed following the adoption of alternative currencies.

From a financial stability perspective, APs view cyber risk as the highest level of risk which they believe was mostly evident in cloud computing, web and mobile applications, and APIs. This was followed by operational risk and reputational risk, mostly evident across cloud computing web and mobile applications, and APIs. Therefore, in terms of the different level of risks, the ranking for cloud computing, web and mobile applications, and APIs were the same across the top three risks. However, most APs believe that the increase in risk for cyber, operational, and reputational risk was mainly low. This indicated that at present there are no imminent threats to financial stability. These results are in line with the findings of studies carried out by the FSB.

## 2 Introduction

The FAS was initiated in line with the Authority's mandate to monitor, understand, and assess the developments and implications of the use of innovative technology and digital transformation occurring in the Maltese financial services sector. The FAS builds on a previous workstream titled *'Demystifying FinTech'* conducted by the MFSA during 2022. With reference to the definition of FinTech adopted locally, the latter workstream (i) assessed and compared it to other definitions adopted internationally, and (ii) identified its key characteristics. Therefore, the FAS builds knowledge and provides the Authority with additional insight to carry out further supervisory engagement and drive policy in the area of FinTech and digital finance locally.[1]

The main objectives of the FAS are to provide an in-depth understanding and analysis on FinTech adoption locally, including (i) assessing existing and prospective DTSs and business strategies, (ii) identifying FinTech Service Providers operating in Malta, (iii) identifying enabling technologies and innovations being utilised, and (iv) analysing the local implications from the adoption of DTSs, including barriers, challenges, benefits, and risks. In this regard, the FAS not only attempts to formulate a FinTech population within the context of the local financial services sector but sets a benchmark for the adoption of innovative and enabling technology in finance for the reference year of 2021.

Following the introduction, the next section presents the methodology utilised to reach the objectives of the FAS. The main results of the FAS Questionnaire are presented in Chapters 4, 5 and 6 respectively. Chapter 4 puts forward the results relating to (i) current and potential future actions towards digitisation, digitalisation, and implementation of enabling technologies and innovations, (ii) objectives towards the adoption of DTSs, and (iii) their capacity. Chapter 5 presents the enabling technologies adopted, whilst Chapter 6 portrays the considerations and implications of FinTech adoption.

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[1] For more information on MFSA FinTech initiatives refer to the [FinTech webpage](.).

# 3 Methodology

The goal of the FAS was reached via the dissemination of an online questionnaire to APs based on their authorisation sectors for the reference year of 2021. The authorisation sectors covered by the FAS Questionnaire represent the key areas within the local financial services landscape. The surveyed authorisation sectors were also chosen based on their potential to develop or implement innovative and enabling technologies in their offering. Table A1.1 within the Annex presents a detailed list of the authorisation sectors covered by the Questionnaire, which are relevant for the scope of the FAS.

It is noted that the definition used by the MFSA is that adopted by the European Commission FinTech Action Plan (2018), EBA (2018) and FSB (2019) which according to the Rule 3 under the MFSA Act (Chapter 330 of the laws of Malta), the Authority defines FinTech as *"technologically-enabled financial innovation that could result in new business models, applications, processes or products with an associated material effect on financial markets and the provision of financial services"* (MFSA, 2020).

Following the definition of FinTech adopted within Rule 3 under Chapter 330 of the laws of Malta and the target population included within the Questionnaire, the results of the FAS do not include responses from technology providers. Under section 2 of same rule, technology providers refer to *"persons, who provide or intend to provide a FinTech Solution, which is only intended for use by one or more third-party financial services providers, and does not intend to use the Solution to undertake any activity which triggers an authorisation in terms of any financial services law currently in force in Malta"*.

The Questionnaire was mainly disaggregated into three sections, (i) the AP's current or potential business and digital transformation strategies, (i) the adoption of enabling and innovative technologies, and (iii) their local considerations and implications to the Maltese economy. Following the dissemination of the FAS Questionnaire to APs falling within the targeted authorisation sectors listed in Table A1.1, a response rate of 95 per cent was attained, covering in total 390 APs and 472 authorisations.

# 4   Business and Digital Transformation Strategy

## 4.1   Adoption of Digital Transformation Strategy

**KEY OBSERVATIONS**

- 52% of APs took actions towards developing or implementing a DTS, of which 6% were accelerated due to the Covid-19 pandemic.
- 61% of APs with a DTS have a document in place outlining their strategy, with the majority adopting a hybrid between explicit and implicit strategies.
- From all those APs having a DTSs, 64% were adopted before 2020, 12% in 2020, and 19% in 2021
- 23% of DTSs have a time horizon of more than three years.
- 57% of DTSs were not updated, followed by 38% that are updated annually.
- The majority of DTSs have an equal focus on back, middle, and front office transformation, amounting to 57%.
- 79% of APs utilised RegTech solutions as part of their DTSs, mostly surrounding the areas of AML/CTF and operational resilience.
- Based on their opinion and the definition of FinTech, APs highlight that 13 per cent qualified as FinTech Service Providers in 2021.
- Although digital transformation will impact the business model viability of around 43% of APs, 57% of APs which do not have a DTS were not considering taking any actions towards digitisation, digitalisation, or implementation of enabling or innovations technologies in the future.

### 4.1.1   Current Actions Towards Developing and Implementing a DTS

APs were asked whether direct or indirect actions have been taken towards digitisation, digitalisation or implementation of enabling technologies and innovations as depicted in Figure 4.1. Therefore, for the purposes of the FAS, Figure 4.1[2] presents the amount of DTSs in place within the local financial services sector for the reference year of 2021. Slightly more than half of APs (52%) took direct or indirect actions towards digitisation, digitalisation, or implementation of enabling technologies and innovations, of which six per cent pinpoint that their DTS was accelerated due to the COVID-19 pandemic (hereinafter, referred to Active APs). The remaining 48 per cent remark that they did not take any action towards digitisation, digitalisation, or implementation towards enabling technologies and innovation (hereinafter, referred to Passive APs).

Active APs were required to indicate the type of strategy in place, whether implicit, explicit, or mixed. In this respect, an implicit strategy refers to a DTS that is embedded or indirectly included within other interlinked documents, an explicit strategy refers to a detailed, stand-alone DTS, whilst a mixed strategy refers to a DTS which is embedded within interlinked documents and supported by a detailed separate strategy.

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[2] As applicable, graphical representations within the FAS are rounded to the nearest significant figure.

■ No   ■ Yes   ■ Yes, accelerated due to the 2019 pandemic

FIGURE 4.1 | ACTIONS TOWARDS DIGITISATION, DIGITALISATION AND/OR IMPLEMENTATION OF ENABLING TECHNOLOGIES AND INNOVATIONS
*SOURCE | AUTHOR'S OWN SOURCES*



FIGURE 4.2 | TYPES OF DIGITAL TRANSFORMATION STRATEGY DOCUMENTS IN PLACE
*SOURCE | AUTHOR'S OWN SOURCES*

As depicted in Figure 4.2, from all Active APs, 61 per cent have a document in place outlining their DTSs. Based on APs with a DTS in place, 34 per cent have a mixed strategy, 23 per cent have an implicit strategy, and lastly four per cent have an explicit strategy. Interestingly, it is noted that 31 per cent of Active APs pinpoint that they do not have an explicit strategy currently in place.

Active APs were also required to indicate the year during which their DTSs were initiated. As illustrated in Figure 4.3, the majority of Active APs (64%) noted that their DTSs were initiated before 2020, whilst 12 per cent and 19 per cent of APs initiated their DTS during 2020 and 2021, respectively.
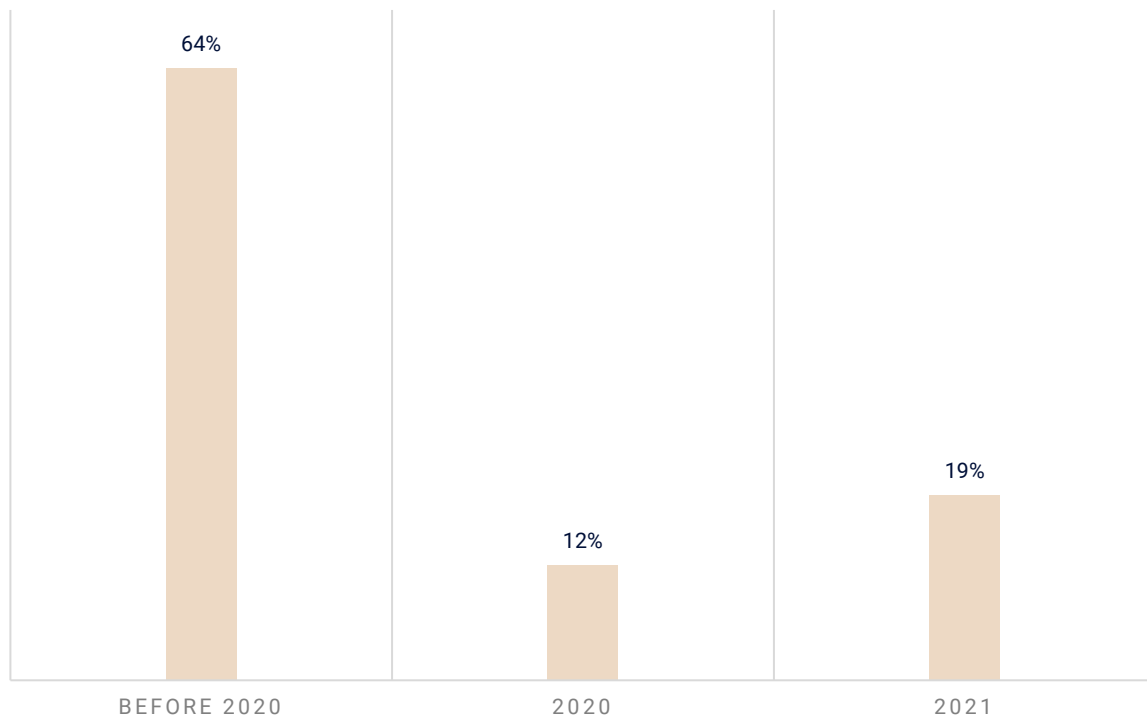


FIGURE 4.3 | REFERENCE YEAR IN WHICH THE DIGITAL TRANSFORMATION STRATEGY WAS INITIATED
*SOURCE | AUTHOR'S OWN SOURCES*

With respect to their DTSs, Figure 4.4 portrays that 23 per cent of active APs have a time horizon of more than three years, 18 per cent have a remaining time of three years, 17 per cent have a remaining time of two years, and ten per cent have a remaining time of one year.

When asked how often their DTSs were updated, as represented in Figure 4.5, 48 per cent of Active APs noted that they updated their DTSs regularly, of which 38 per cent update their DTSs annually, four per cent semi-annually, four per cent every two years, and two per cent every three years. On the other hand, 27 per cent of APs do not regularly update their DTSs, with a further 9 per cent who do not update their strategies at all.
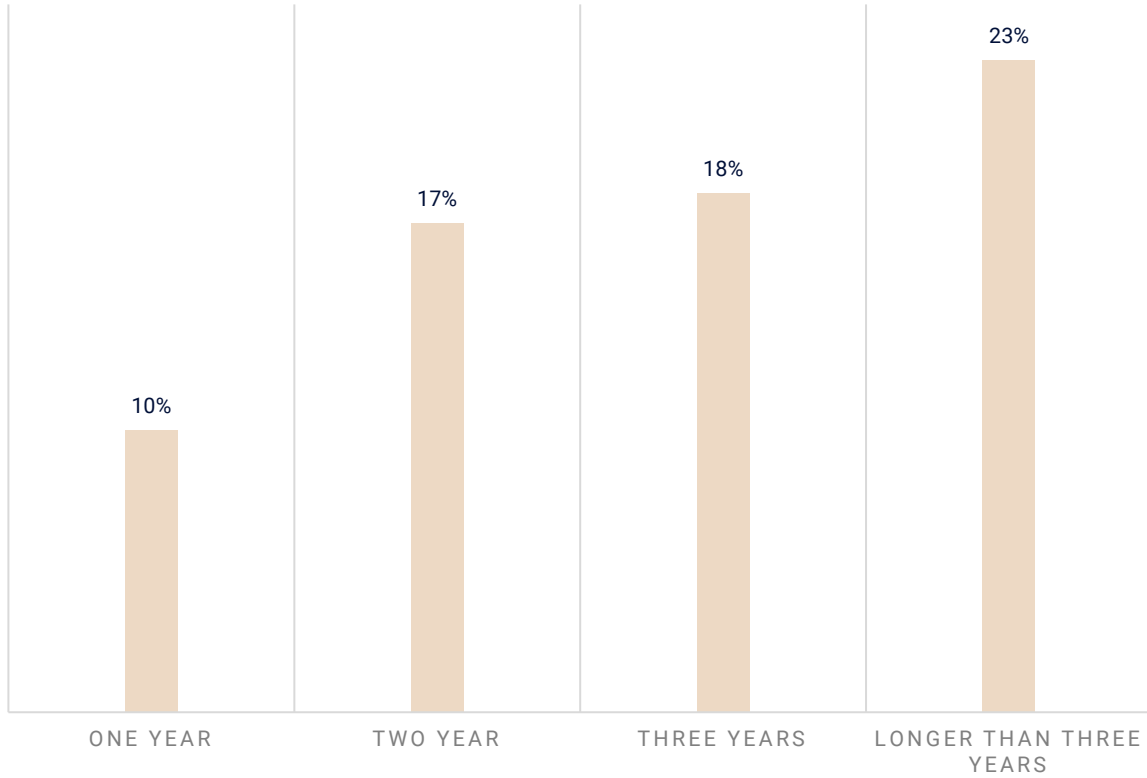
FIGURE 4.4 | TIME HORIZON OF DIGITAL TRANSFORMATION STRATEGIES
*SOURCE | AUTHOR'S OWN SOURCES*

| Updated Regularly | | | |
|---|---|---|---|
| 48% | | | |
| Annually \| 38% | Half-Annually \| 4% | Every Two Years \| 4% | Every Three Years \| 2% |
| Updated Irregularly | | | |
| 27% | | | |
| Not Updated | | | |
| 9% | | | |
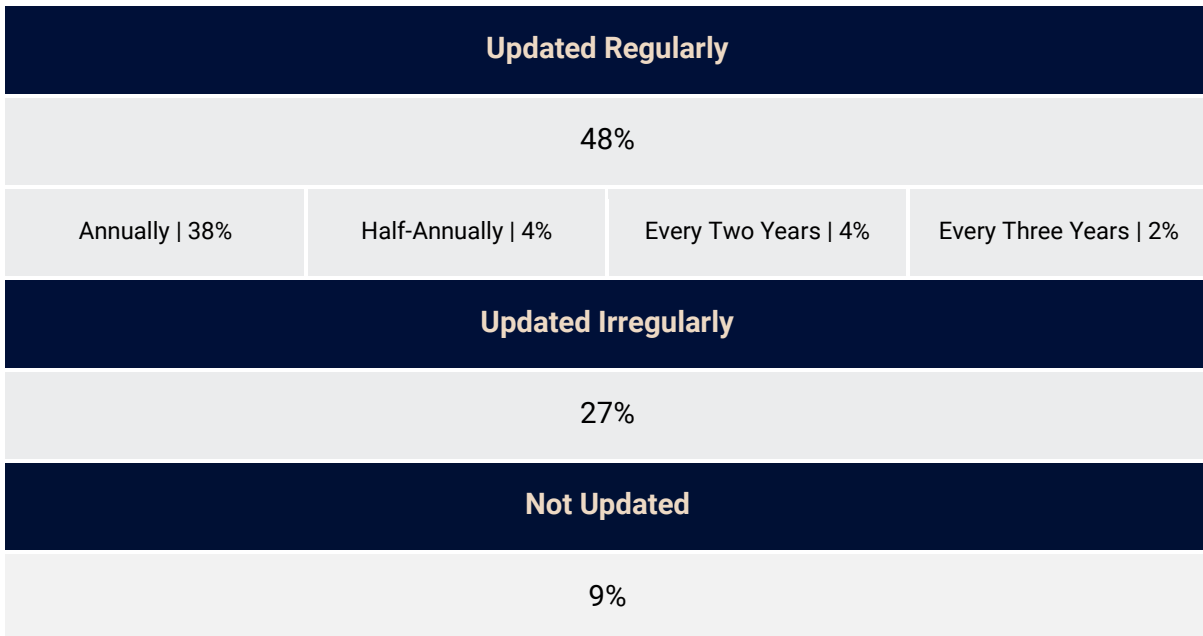
*Note: Figures may not equate to 100 per cent given that certain APs may have not provided information.*

FIGURE 4.5 | UPDATING FREQUENCY OF DIGITAL TRANSFORMATION STRATEGIES
*SOURCE | AUTHOR'S OWN SOURCES*

Figure 4.6 presents the business areas of APs with a DTS in place. The majority of DTSs at 57 per cent have an equal focus on back, middle, and front office transformation. This was followed by 28 per cent of DTSs which focus on the back and middle office transformation and six per cent of DTSs which focused on front office transformation.

| Front Office Transformation | |
| --- | --- |
| Large Focus \| 2% | Slight Focus \| 4% |
| **Back or Middle Office Transformation** | |
| Large Focus \| 21% | Slight Focus \| 7% |
| **Back, Middle and Front Office Transformation** | |
| Equal Focus \| 57% | |
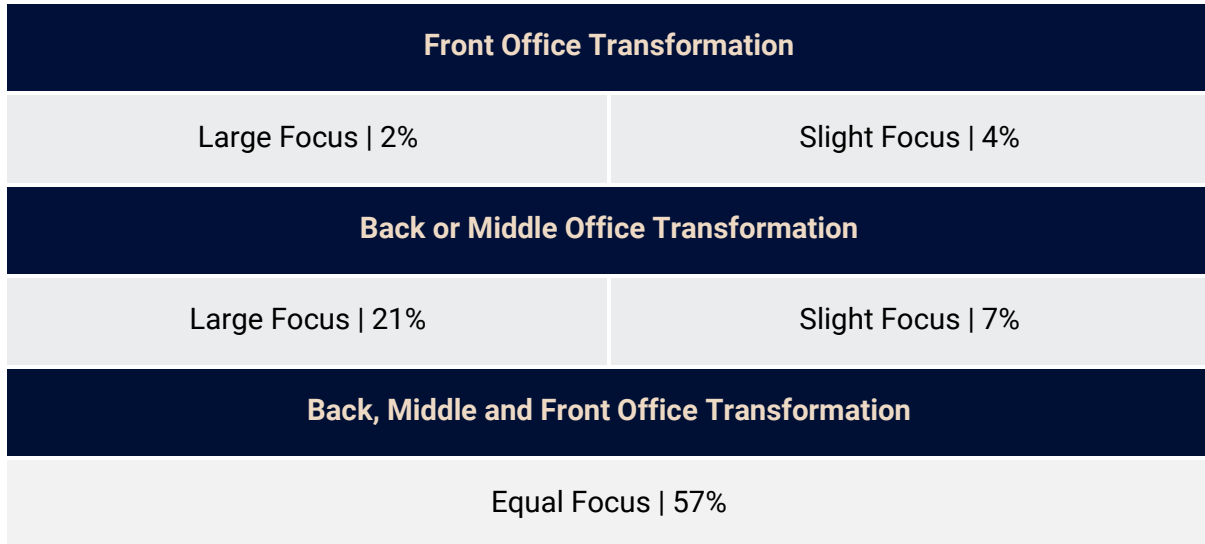
FIGURE 4.6 | BUSINESS AREAS OF DIGITAL TRANSFORMATION STRATEGIES
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.1.2 RegTech Areas and Solutions

Figure 4.7 depicts the adoption of RegTech solutions by APs in their DTSs. From Figure 4.7, 79 per cent of APs indicate that as part of their DTSs, RegTech solutions were utilised, while the remaining 21 per cent indicate that they do not utilise RegTech solutions.



■ No RegTech Solutions Utilised
■ RegTech Solutions Utilised
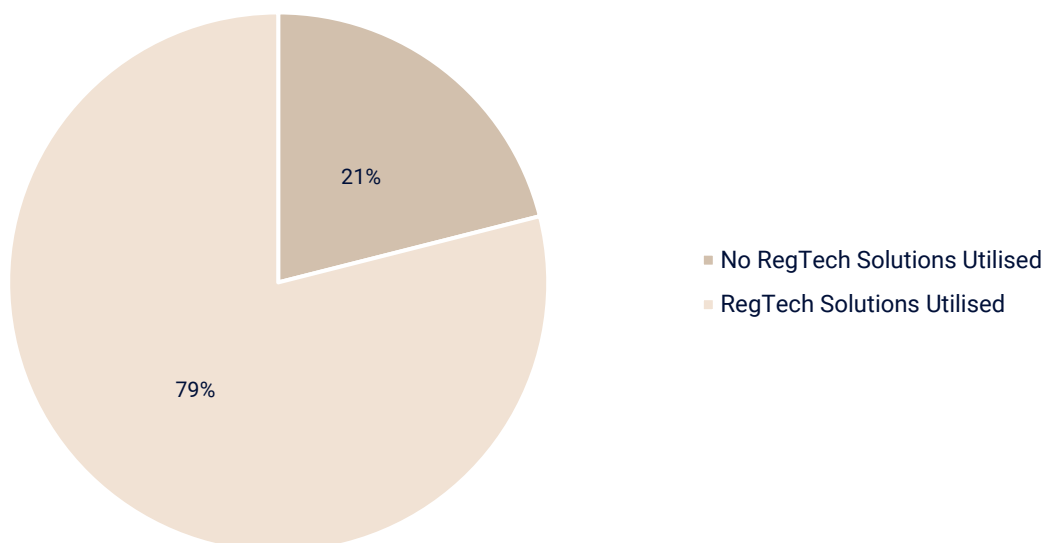
FIGURE 4.7 | REGTECH SOLUTIONS INCLUDED IN DIGITAL TRANSFORMATION STRATEGY
*SOURCE | AUTHOR'S OWN SOURCES*
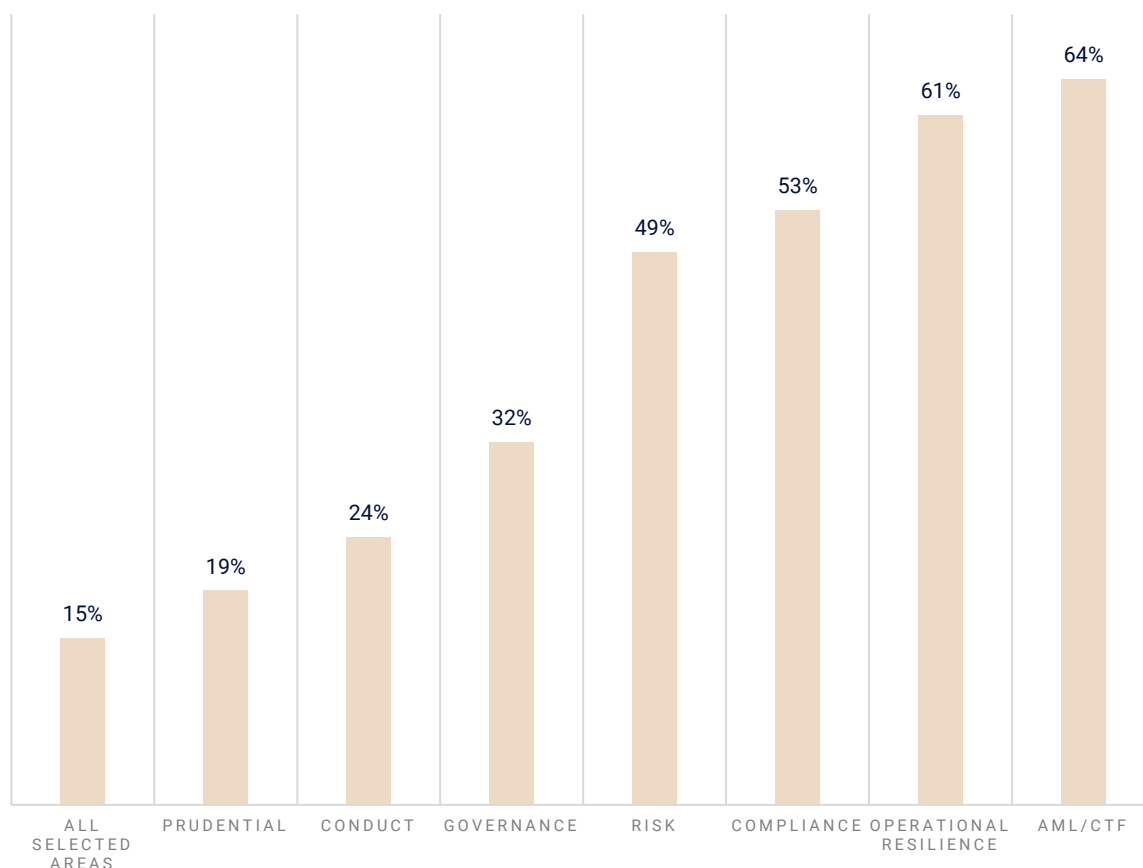
FIGURE 4.8: AREAS OF REGTECH SOLUTIONS
*SOURCE: AUTHOR'S OWN SOURCES*

Building on the findings presented in Figure 4.7, Figure 4.8 pinpoints the areas within which APs were utilising RegTech solutions in their DTSs. The top three areas identified were (i) AML and CTF amounting to 64 per cent, (ii) operational resilience[3] amounting to 61 per cent, and (iii) compliance, amounting to 53 per cent.

### 4.1.3 Eligibility as a FinTech Service Provider

All APs were also required to indicate whether they fall within scope of the definition of a FinTech Service Provides[4], including the year in which they were deemed as eligible. In this context, Figure 4.9 indicates that while 71 per cent of APs do not consider themselves as falling within scope of the definition, 13 per cent of APs consider themselves as falling within scope by end of 2021, one per cent as at end 2022, and two per cent beyond 2022. It is noted that the definition used is very narrow and only considers those APs who are truly undertaking technology-enabled financial innovation.

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[3] Within the context of the FAS, operational resilience focuses on ICT and cybersecurity.

[4] It is noted that the figures presented within this sub-section are based on the views of the respondents.
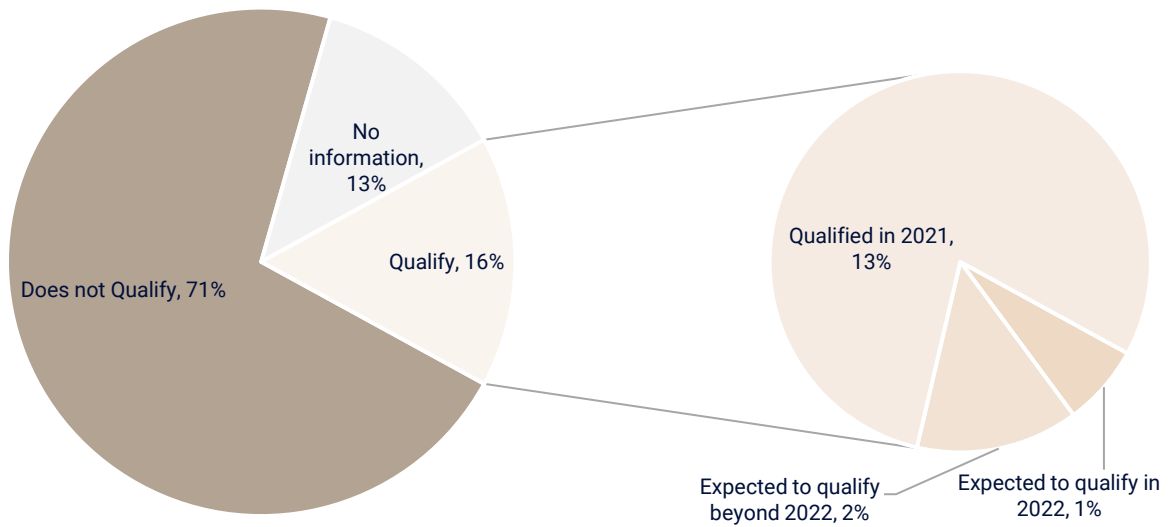
FIGURE 4.9 | FINTECH SERVICE PROVIDER ELIGIBILITY
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.1.4 Future Actions Towards Developing and Implementing a DTS

When delving into the Passive APs or those APs not qualifying as FinTech Service Providers, 57 per cent of such APs indicated that they do not intend to take future actions towards digitisation, digitalisation, or implementation of enabling technologies and innovations. This notwithstanding, 39 per cent of APs may consider undertaking future actions, while only four per cent will be undertaking future actions. These figures are presented in Figure 4.10.
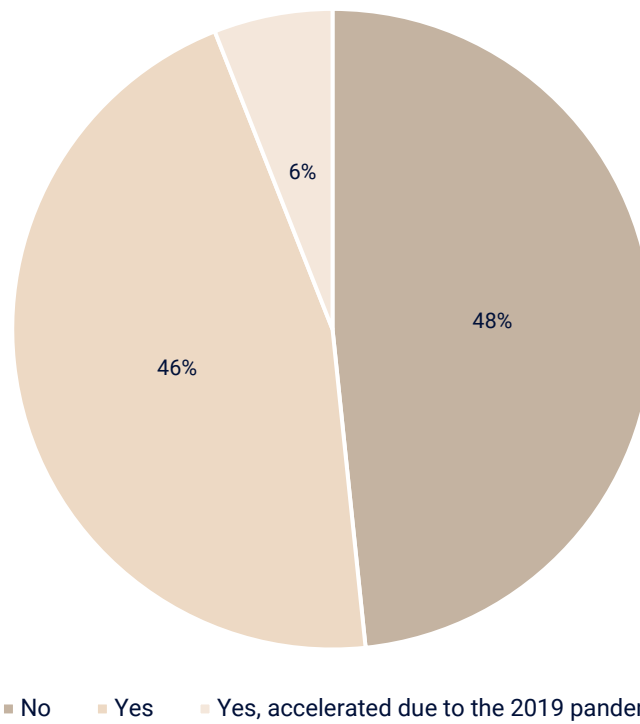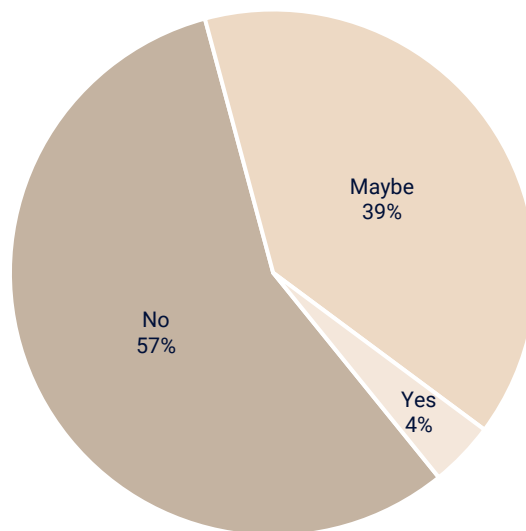


FIGURE 4.10 | POTENTIAL FUTURE ACTIONS TOWARDS DIGITISATION, DIGITALISATION OR IMPLEMENTATION OF ENABLING TECHNOLOGIES AND INNOVATIONS
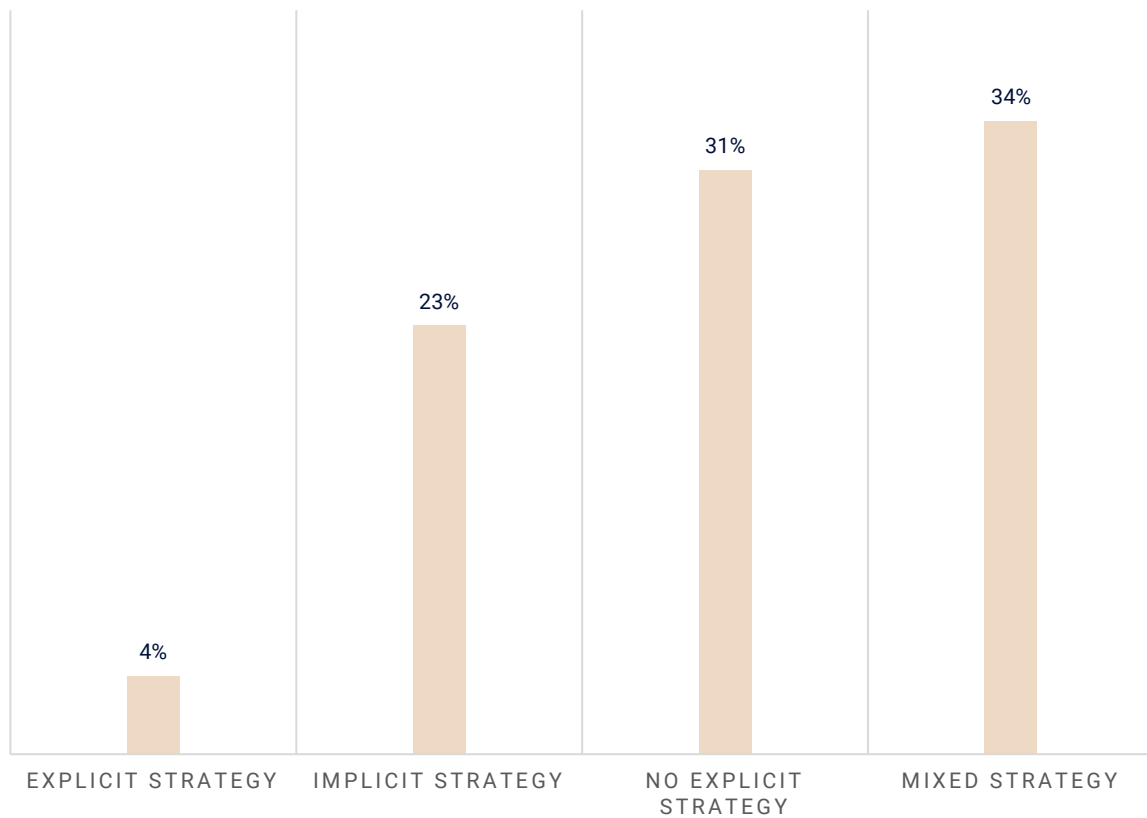*SOURCE | AUTHOR'S OWN SOURCES*

### 4.1.5   Business Model Viability and Impact

Passive APs, APs not qualifying as FinTech Services Providers, and those APs who do not intend to take future actions were also required to indicate whether their management body had taken into consideration their inaction on the APs future viability of their business model. In this respect, as highlighted in Figure 4.11, 67 per cent of such APs indicated that such considerations have been taken into account by their management body.

The same APs were also required to indicate how the digital transformation occurring within the local financial service landscape was relevant to their business model viability. As presented in Figure 4.12, 43 per cent of APs indicated that digital transformation within the financial services sector will have an impact on their business model viability, of which 34 per cent indicated a low impact, seven per cent a medium impact, and two per cent a high impact. The remaining 35 per cent of APs highlighted that the digital transformation occurring within the financial services sector will not have any influence.
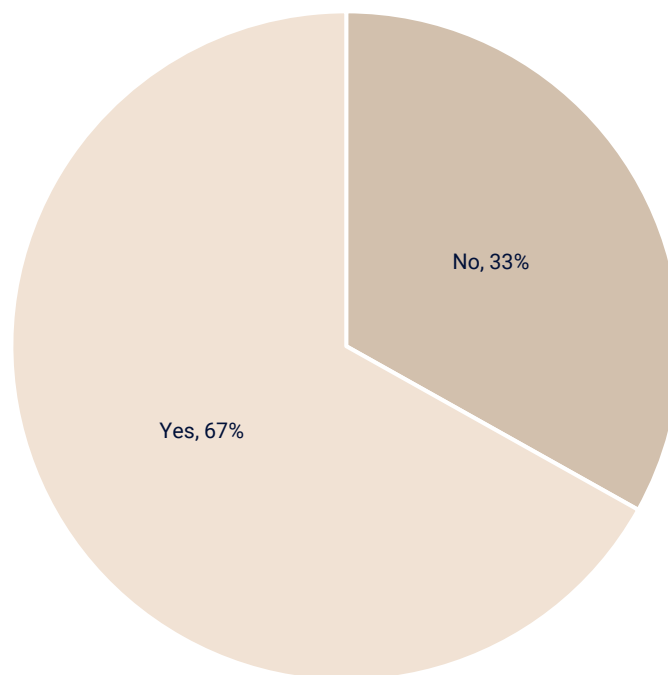


FIGURE 4.11 | CONSIDERATION OF FUTURE BUSINESS MODEL VIABILITY AT THE LEVEL OF MANAGEMENT BODY
*SOURCE | AUTHOR'S OWN SOURCES*
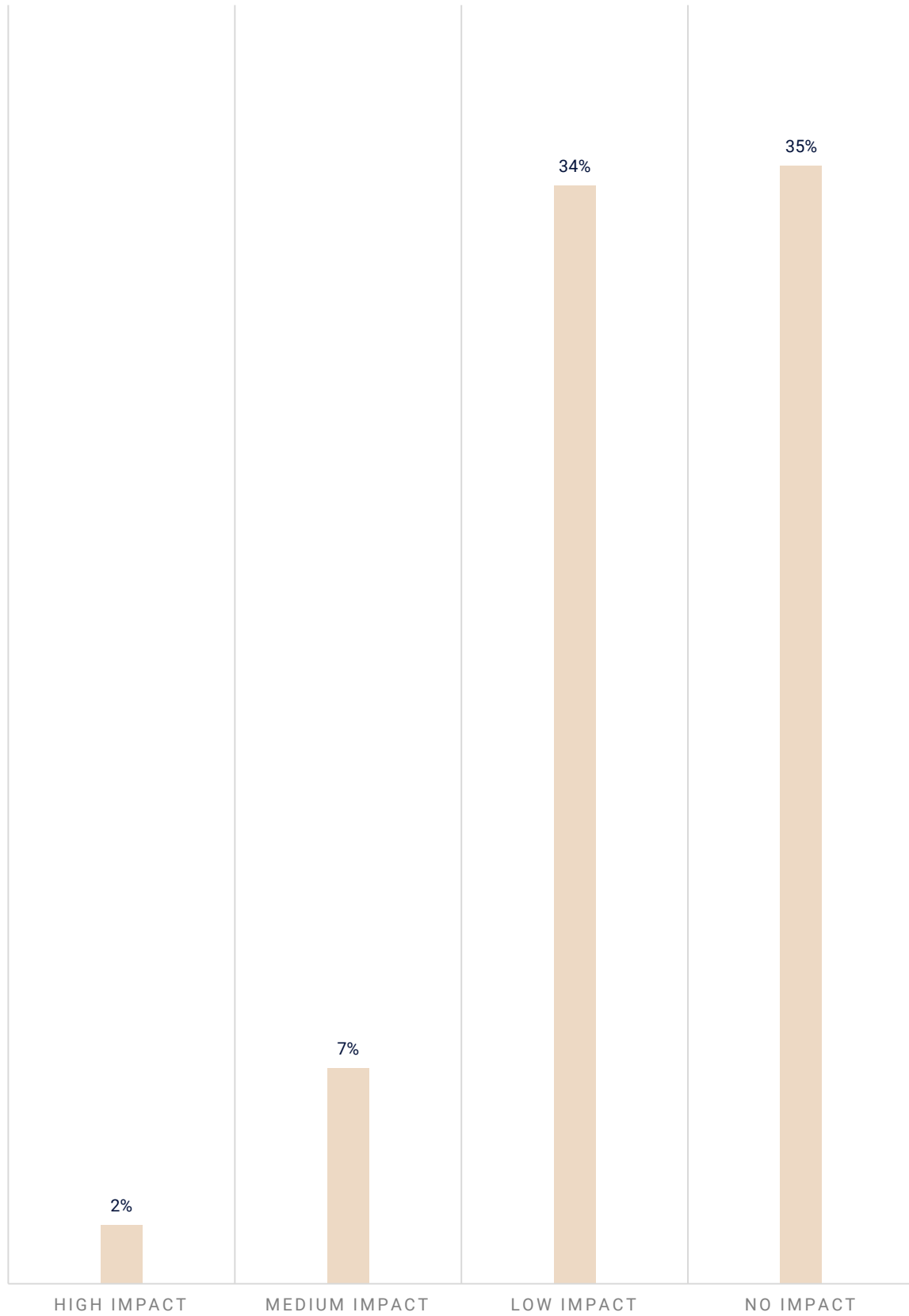
FIGURE 4.12 | DIGITAL TRANSFORMATION SIGNIFICANCE OCCURRING WITHIN THE FINANCIAL SERVICES LANDSCAPE TO THE BUSINESS MODEL VIABILITY
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.2 Objectives

- The top 3 objectives with the highest degree of significance towards the development and implementation of a DTS were (i) enhanced efficiencies (62%), (ii) enhanced customer experience and engagement (55%), and (iii) reduction of operational risks associated with information and cyber security (45%).
- Reduction in real estate costs (66%), monetisation of client data (62%), and cheaper regulatory costs (40%) were the top three factors not deemed as objectives to develop and implement a DTS.
- The top 3 objectives with the highest benefits were (i) enhanced efficiencies (35%), (ii) reduction of money laundering and terrorist financing risk (34%), and (iii) enhanced customer experience and engagement (33%).
- Reduction of real estate costs (29%), monetisation of client data (23%), and improved pricing (16%) were the top three objectives that did not provide any benefit from the development and implementation of a DTS.

Based on Active APs, or those APs which qualify or are expected to qualify as FinTech Service Providers, Figure 4.13 presents a list of objectives and their degree of influence towards the development or implementation of a DTS.

From Figure 4.13, the top three objectives which provided the highest significance for such APs were (i) enhanced efficiencies (62%), (ii) enhanced customer experience and engagement (55%), and (iii) reduction of operational risks associated with information and cyber security (45%). These were closely followed by reduction of money laundering and terrorist financing risk, which amounted to 43 per cent. Additionally, when taking into consideration objectives with medium significance, while the latter four objectives scored the highest in terms of significance, reduction of operation cost also became relevant, with a total of 87 per cent, thereby qualifying as one of the top three objectives. Conversely, reduction in real estate costs (66%), monetisation of client data (62%), and cheaper regulatory costs (40%) were the top three factors which were not an objective in the APs' DTS.

Building on the results presented in Figure 4.13, APs were also required to indicate the impact the objectives had towards the development and implementation of their DTS. These findings are depicted in Figure 4.14. The top three objectives with the highest benefit were (i) enhanced efficiencies, (ii) reduction of money laundering and terrorist financing risk, and (iii) enhanced customer experience and engagement, amounting to 35, 34 and 33 per cent, respectively.

Meanwhile, the (i) reduction of real estate costs (29%), (ii) monetisation of client data (23%), and (iii) improved pricing (16%) were identified by APs as the top three objectives which provided no benefit. Similarly, these objectives provided the least benefit to APs when taking into consideration the low, moderate, and high classifications.

| | No Information Available | Not an objective | Low Significance | Medium Significance | High Significance |
|---|---|---|---|---|---|
| ENHANCED EFFICIENCIES | 5% | 2% | 3% | 28% | 62% |
| ENHANCED CUSTOMER EXPERIENCE/ENGAGEMENT | 5% | 10% | 8% | 22% | 55% |
| REDUCTION OF OPERATIONAL RISK - CYBER SECURITY | 5% | 9% | 10% | 31% | 45% |
| REDUCTION OF MONEY LAUNDERING/TERRORIST FINANCING RISK | 8% | 13% | 9% | 27% | 43% |
| INCREASED SCALABILITY | 6% | 10% | 9% | 38% | 37% |
| IMPROVED DATA AGGREGATION/RECONCILIATION | 6% | 9% | 11% | 38% | 37% |
| REDUCTION OF OPERATIONAL RISK - OTHER | 7% | 10% | 10% | 37% | 37% |
| ENHANCED OFFERING | 5% | 14% | 13% | 31% | 36% |
| AVAILABILITY/USE OF IT OR DATA ANALYTICAL TOOLS | 6% | 8% | 13% | 39% | 34% |
| REDUCTION OF COMPLIANCE RISK | 7% | 10% | 15% | 34% | 34% |
| REDUCTION OF OPERATIONAL RISK - FRAUD | 6% | 14% | 15% | 33% | 32% |
| GREATER MARKET SHARE/NEW MARKETS ACCESS | 7% | 22% | 14% | 27% | 30% |
| REDUCTION OF OPERATIONAL COSTS | 5% | 8% | 12% | 45% | 30% |
| HIGHER PROFITS | 6% | 13% | 17% | 36% | 27% |
| ELIMINATION OF LEGACY IT SYSTEMS | 8% | 27% | 16% | 22% | 27% |
| REDUCTION OF CONDUCT RISK | 8% | 17% | 16% | 34% | 25% |
| REDUCTION OF PRUDENTIAL RISK | 12% | 21% | 18% | 26% | 23% |
| PIONEERING THE INDUSTRY | 7% | 33% | 21% | 17% | 22% |
| HIGHER VALUATION | 8% | 28% | 19% | 24% | 20% |
| IMPROVED PRICING | 7% | 24% | 23% | 31% | 15% |
| REDUCTION OF HUMAN RESOURCE COSTS | 5% | 19% | 28% | 34% | 14% |
| REDUCTION OF IT COSTS | 6% | 31% | 27% | 25% | 11% |
| REDUCTION OF REGULATORY COSTS | 7% | 40% | 22% | 20% | 11% |
| MONETISATION OF CLIENT DATA | 9% | 62% | 14% | 8% | 7% |
| REDUCTION OF REAL ESTATE COSTS | 9% | 66% | 14% | 8% | 4% |

FIGURE 4.13 | SIGNIFICANCE OF THE OBJECTIVES TOWARDS ADOPTING A DIGITAL TRANSFORMATION STRATEGY
*SOURCE | AUTHOR'S OWN SOURCES*
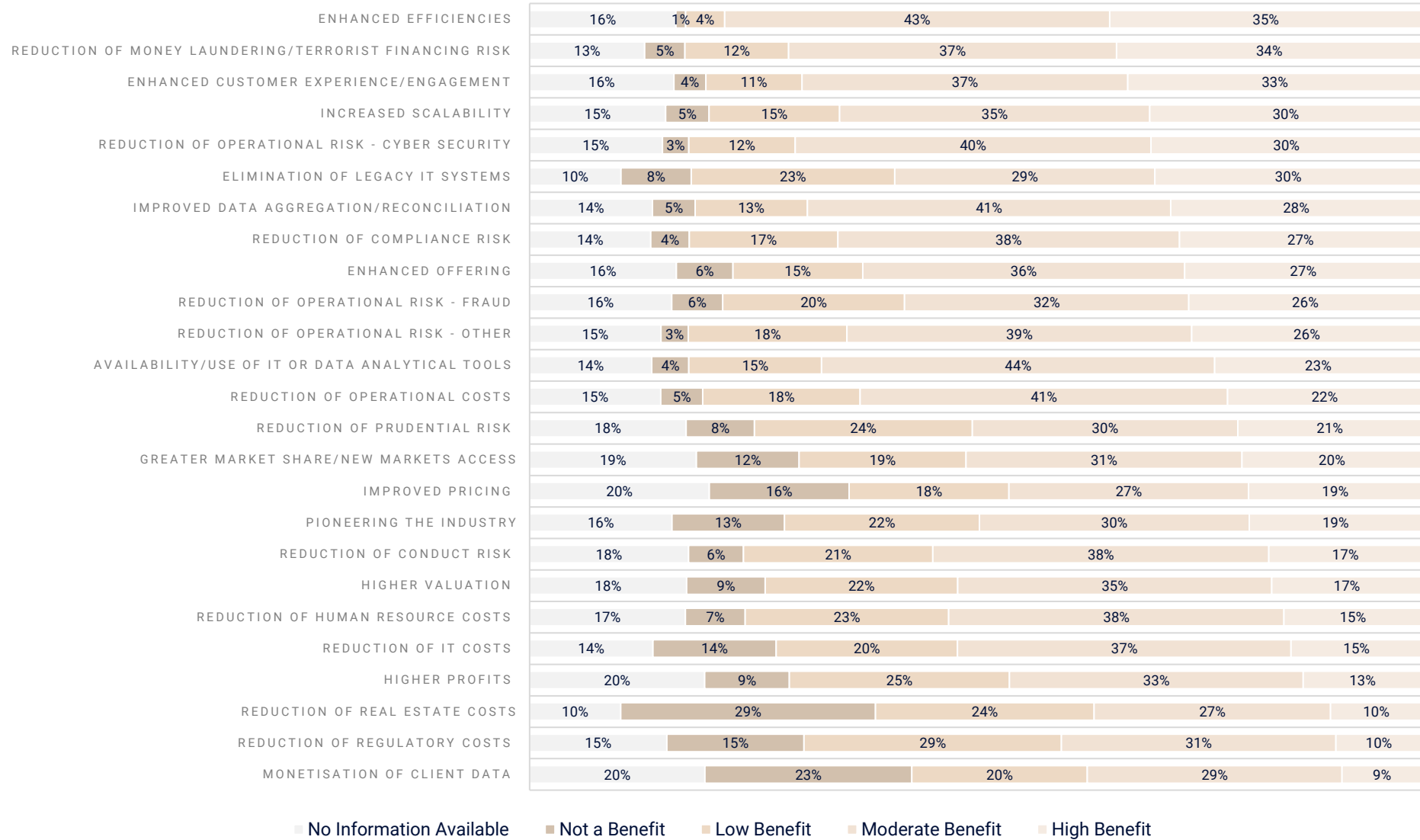
FIGURE 4.14 | BENEFITS IN ADOPTING THE OBJECTIVES TOWARDS THE DEVELOPMENT AND IMPLEMENTATION OF DTS
*SOURCE | AUTHOR'S OWN SOURCES*

## 4.3 Capacity

- Own funding was the preferred method (89%) for APs to finance their DTSs.
- 70% of APs utilised third-party providers to adopt their DTS.
- APs mostly dedicated between 0 - 25% of their internal FTE workforce, IT budget, and DTS's budget towards the development and implementation of their DTSs.

### 4.3.1 Main Sources of Financing

From a list of key financing sources, APs had to provide information on the methods utilised to fund their DTSs, as depicted in Table A2.1 within the Annex. From Table A2.1, the preferred method for APs to finance their DTSs is through their own funding. As presented in Figure 4.15, 89 per cent of APs utilise their own funds to finance their DTSs. From this figure, 57 per cent consider this financing source highly important, 25 per cent as important, and eight per cent least important. From Table A2.1 within the Annex, the top three financing methods not utilised were crowdfunding (89%), business angels (87%) and venture capital (86%). The data for the remaining sources of financing is available in Table A2.1.
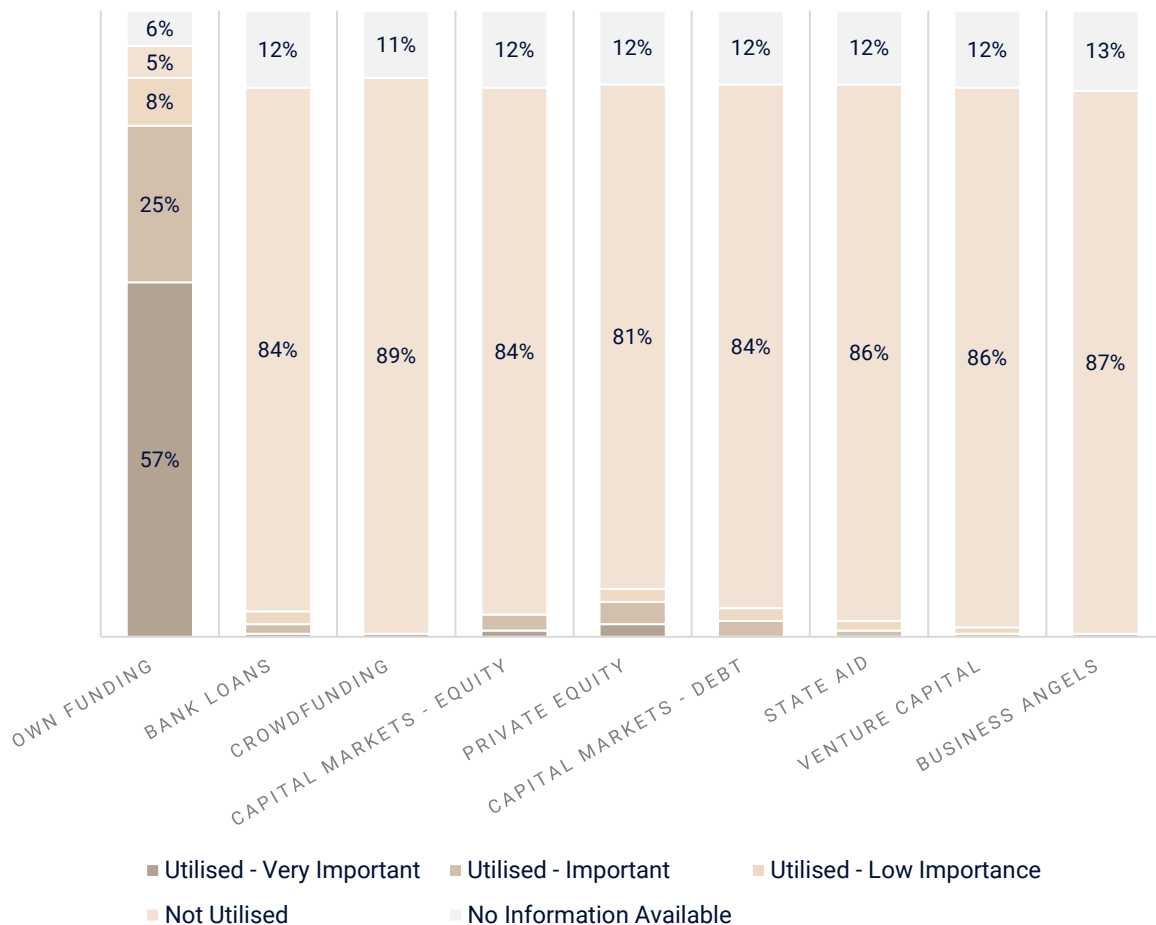


FIGURE 4.15 | MAIN SOURCES OF FINANCING FOR DEVELOPING AND IMPLEMENTING DTSS
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.3.2   Cooperation Methods

From a list of cooperation methods, APs had to indicate the approach utilised in order to develop and implement their DTSs. In this context, the cooperation method mostly utilised by APs was third-party providers at 70 per cent, followed by consultants at 62 per cent. Interestingly, 41 per cent of APs indicated that they use some form of cooperation method. Figure 4.16 and Table A2.2 present the several cooperation methods applied by APs to develop and implement their DTSs.

When focusing on APs utilising third-party providers, as illustrated in Figure 4.16, 35 per cent prefer and mostly used this approach, 23 per cent frequently used the approach, ten per cent occasionally utilised the approach, and two per cent very seldomly used the approach. Similarly, when focusing on the use of consultants, 18 per cent of APs prefer and mostly used such cooperation method, 19 per cent frequently used this approach, 19 per cent occasionally utilised the approach, and six per cent very seldomly used the approach.
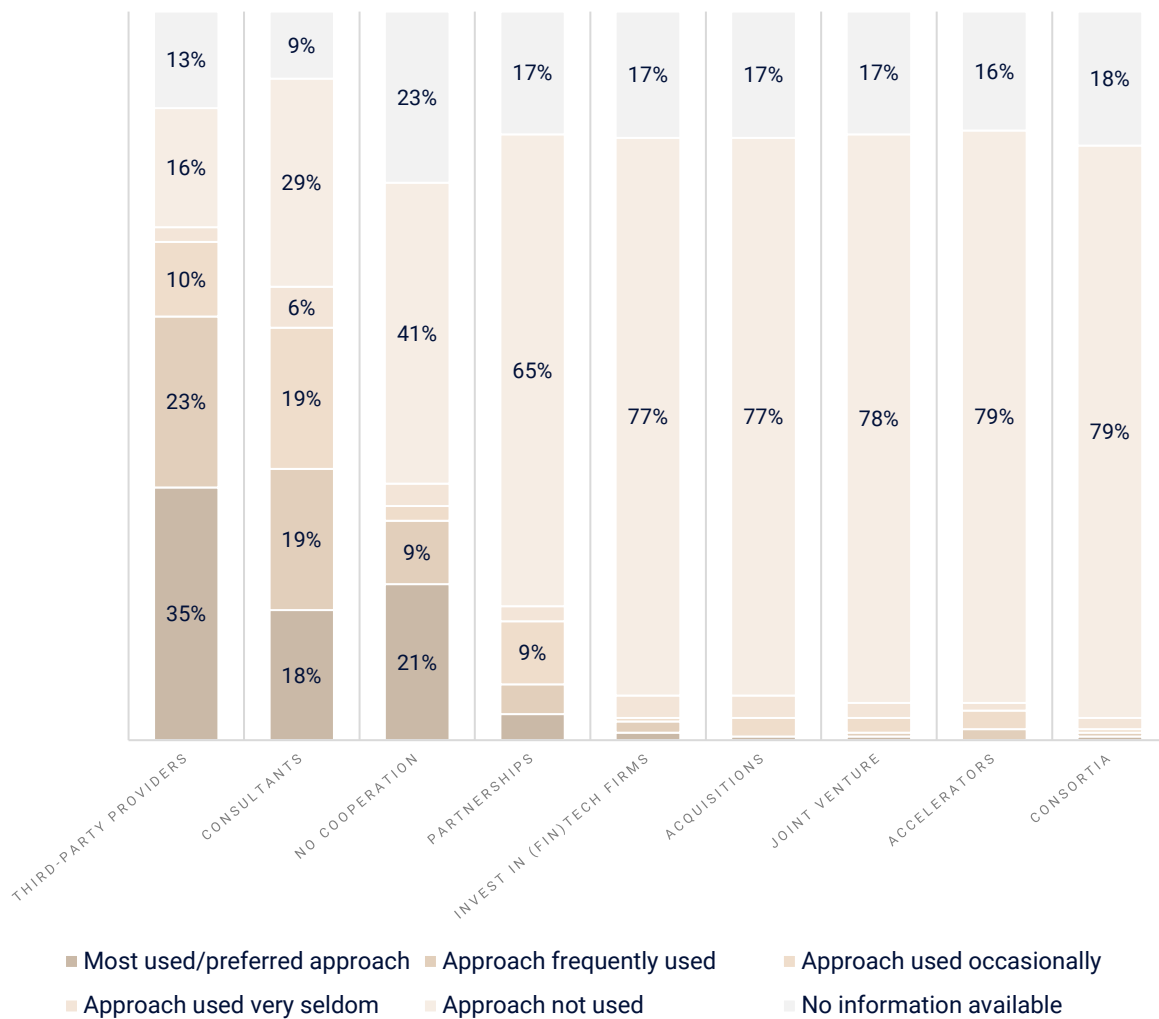


FIGURE 4.16 | COOPERATION TO DEVELOP AND IMPLEMENT ITS DIGITAL TRANSFORMATION STRATEGY
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.3.3   Workforce

Figure 4.17 presents the results across four different brackets reflecting the percentage of the AP's total internal FTE workforce involved in the direct delivery of their DTS for the year ending 2021. As illustrated in Figure 4.17, most APs, at 74 per cent, dedicate only between zero to 25 per cent of their total internal FTE workforce towards the development and implement their DTS.
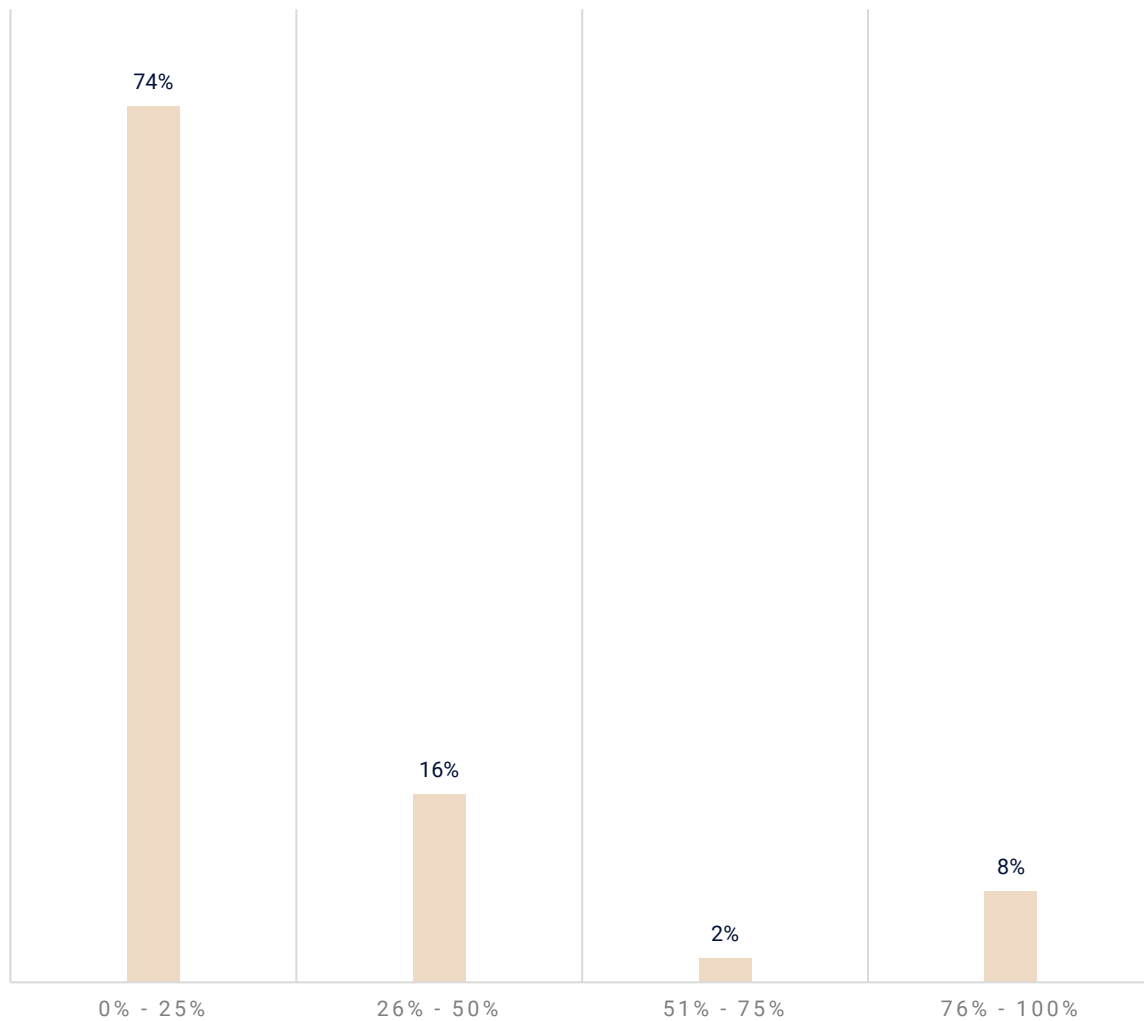


FIGURE 4.17 | PERCENTAGE OF TOTAL INTERNAL FTE WORKFORCE INVOLVED IN THE DIRECT DELIVERY OF THE DTS AS AT END 2021
*SOURCE | AUTHOR'S OWN SOURCES*

### 4.3.4   Information Technology and DTS Budget

Figure 4.18 focuses on how much of the APs' IT and DTS budget is currently being allocated from the total operating budget for the year ending 2021. In this respect, 85 per cent of APs dedicated between zero to 25 per cent of their IT budget as a percentage of total operating budget. This is followed by 12 per cent of APs that dedicated between 26 to 50 per cent of

their IT budget as a percentage of total operating budget. The least number of APs were identified across the 76 to 100 per cent category, resulting in only one per cent of APs allocating resources towards IT for the reference year of 2021.

When questioning the budget specifically allocated towards the development and implementation of the DTSs as a percentage of total operating budget for the reference year of 2021, 88 per cent of APs noted that amount was between zero to 25 per cent. This was followed by nine per cent of APs that allocated between 26 to 50 per cent of their budget towards the development and implementation of their DTS. The least number of APs were identified across the 51 to 75 per cent and the 76 to 100 per cent categories, amounting to two per cent.



■ DTS Development and Implementation Budget as a Percentage of Total Operating Budget as at end 2021

■ IT budget as a percentage of Total Operating Budget as at end 2021
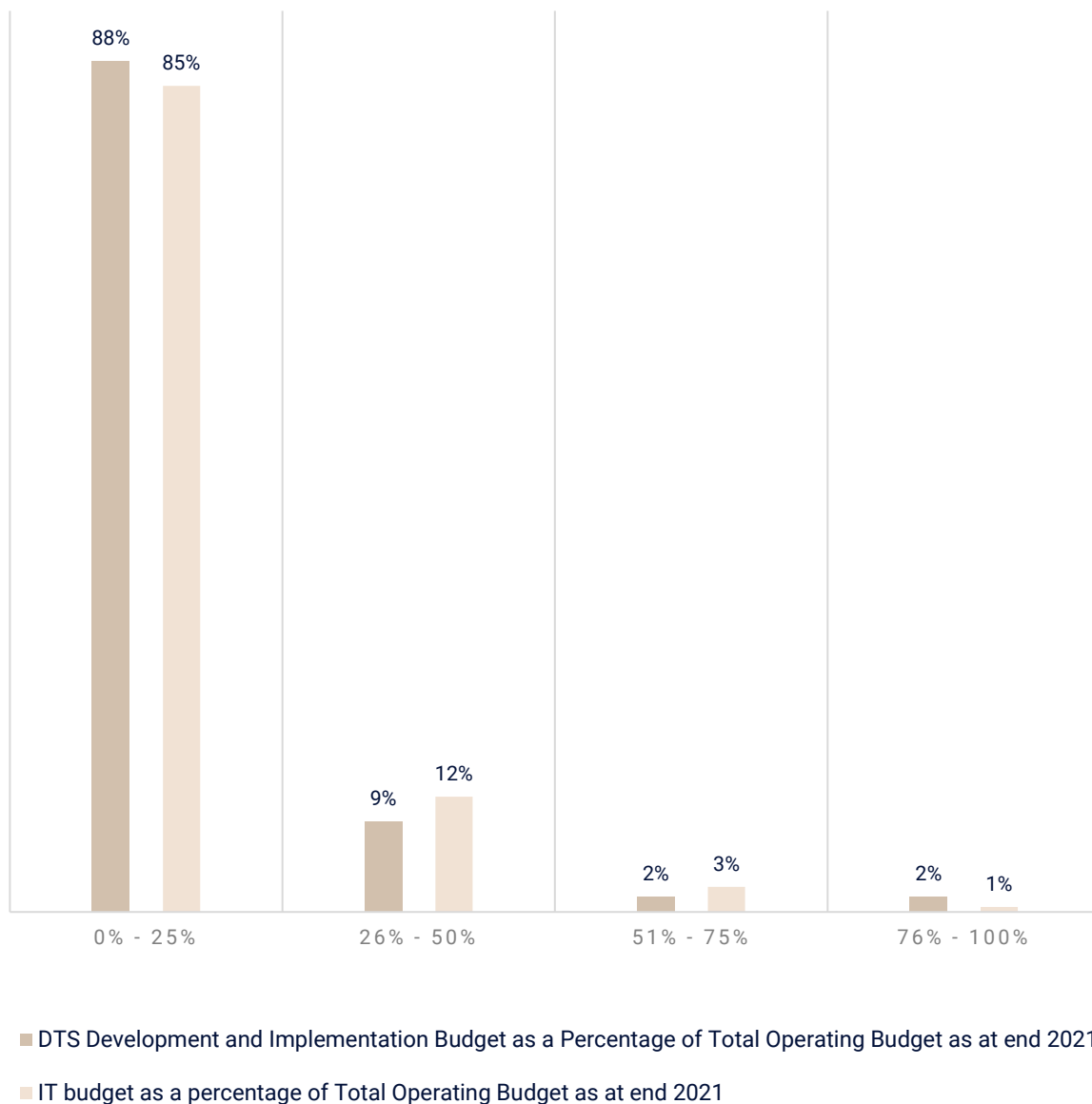
FIGURE 4.18 | INFORMATION TECHNOLOGY BUDGET AS A PERCENTAGE OF TOTAL OPERATING BUDGET AS AT END 2021
*SOURCE | AUTHOR'S OWN SOURCES*

# 5 Enabling and Innovative Technologies

This section presents the results pertaining to the (i) adoption of enabling technology, and (ii) applicability, adoption stage, deployment time and the ownership of technological solutions within the Maltese financial services sector for 2021. Additionally, within the context of cloud computing the different type of deployment models was also questioned. Following the significant amount of data collected, analysis pertaining to the applicability, deployment time, and ownership of technological solutions are based on the top five applications of enabling technology within the context of the Maltese financial services sector. However, the analysis with regards to the stage of adoption for every enabling technology presented in this section focuses only on the top five applicable solutions for each respective enabling and innovative technology. The full set of results are presented within the Annex of this study.

## 5.1 Adoption

**KEY OBSERVATIONS**

- The top 3 enabling and innovative technologies were cloud computing (77%), APIs (61%) and web and mobile applications (59%), while the least 3 were quantum computing (0%), AR and VR (2%), and DLT (8%).
- Generally, cloud computing was the most adopted technology across all sectors, namely, the Insurance Intermediaries (27%), Investment Service Providers (22%) and Investment Funds (18%).
- APIs were mostly adopted across Financial Institutions (20%), VFA Service providers (16%), and Insurance Undertakings (16%).

As depicted in Figure 5.1, APs were required to provide information on the enabling technologies adopted in their DTSs. From Figure 5.1, based on the APs which have taken, or intend to take actions towards implementing and developing a DTS, the top three enabling technologies adopted were cloud computing (77%), API (61%), and web and mobile applications[5] (59%). On the other hand, the least three enabling technologies adopted across all DTSs were quantum computing amounting to zero per cent, AR and VR amounting to two per cent, and DLT amounting to eight per cent. When taking into consideration all APs falling within scope of this study, the ranking remained the same albeit lower.

Figure 5.2 presents the top five enabling technologies adopted within the Maltese financial services landscape, disaggregated across the selected authorisation sectors for the year ending 2021. While cloud computing was generally the most adopted technology, it was mostly adopted by Insurance Intermediaries (27%), Investment Service Providers (22%) and Investment Funds (18%). This was followed by APIs, mostly adopted across Financial Institutions (20%), VFA Service providers (16%) and Insurance Undertakings (16%). Also, for the third most adopted technology, web and mobile applications were mostly adopted in Investments Funds (18%), Insurance Intermediaries (16%), and VFA Service Providers (16%).

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[5] The adoption of web and mobile applications include applications on smart devices and Web 3.0.
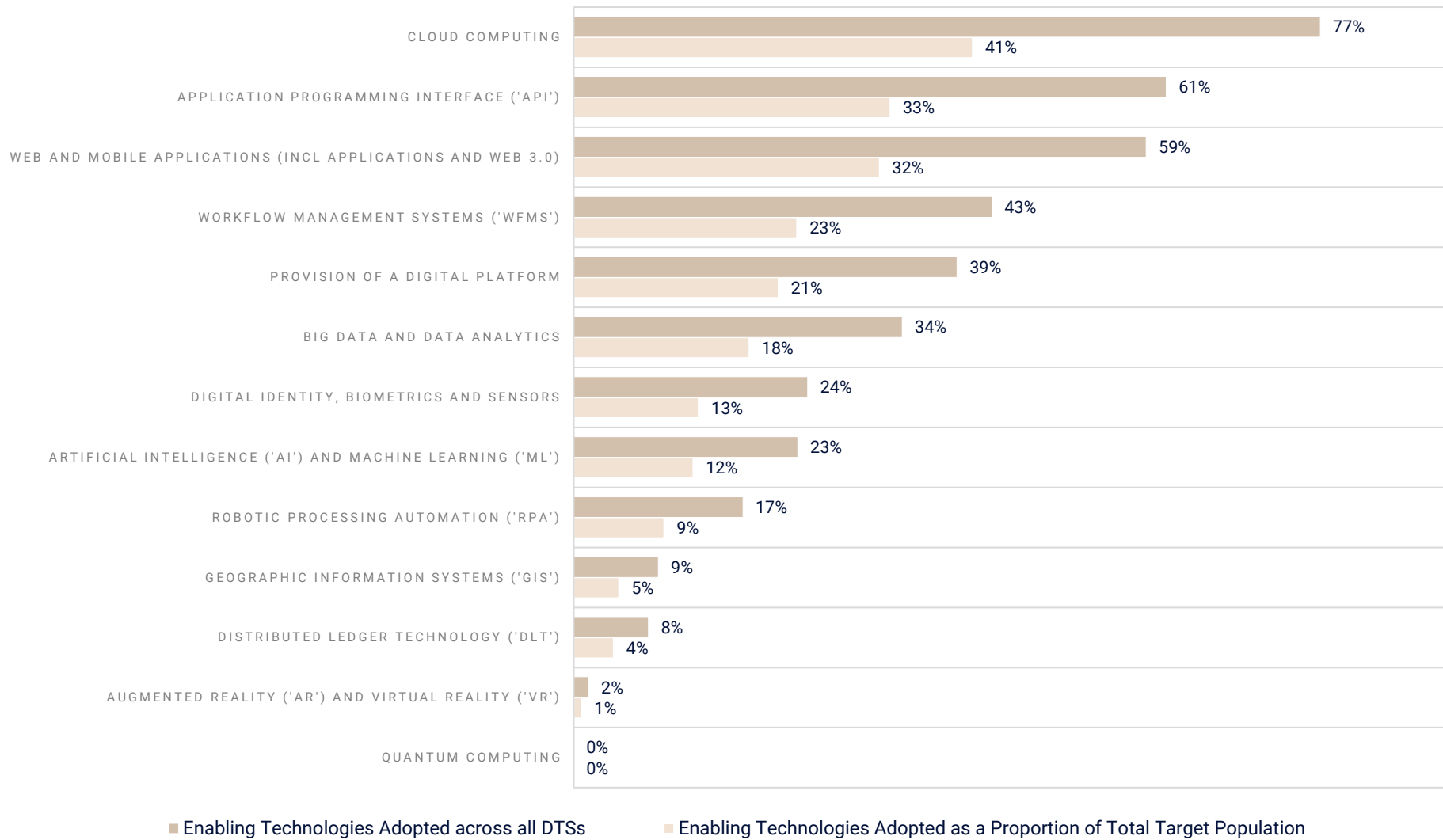
FIGURE 5.1 | ENABLING TECHNOLOGY ADOPTED ACROSS ALL DTSS AND TOTAL TARGET POPULATION FOR THE REFERENCE YEAR OF 2021
*SOURCE | AUTHOR'S OWN SOURCES*
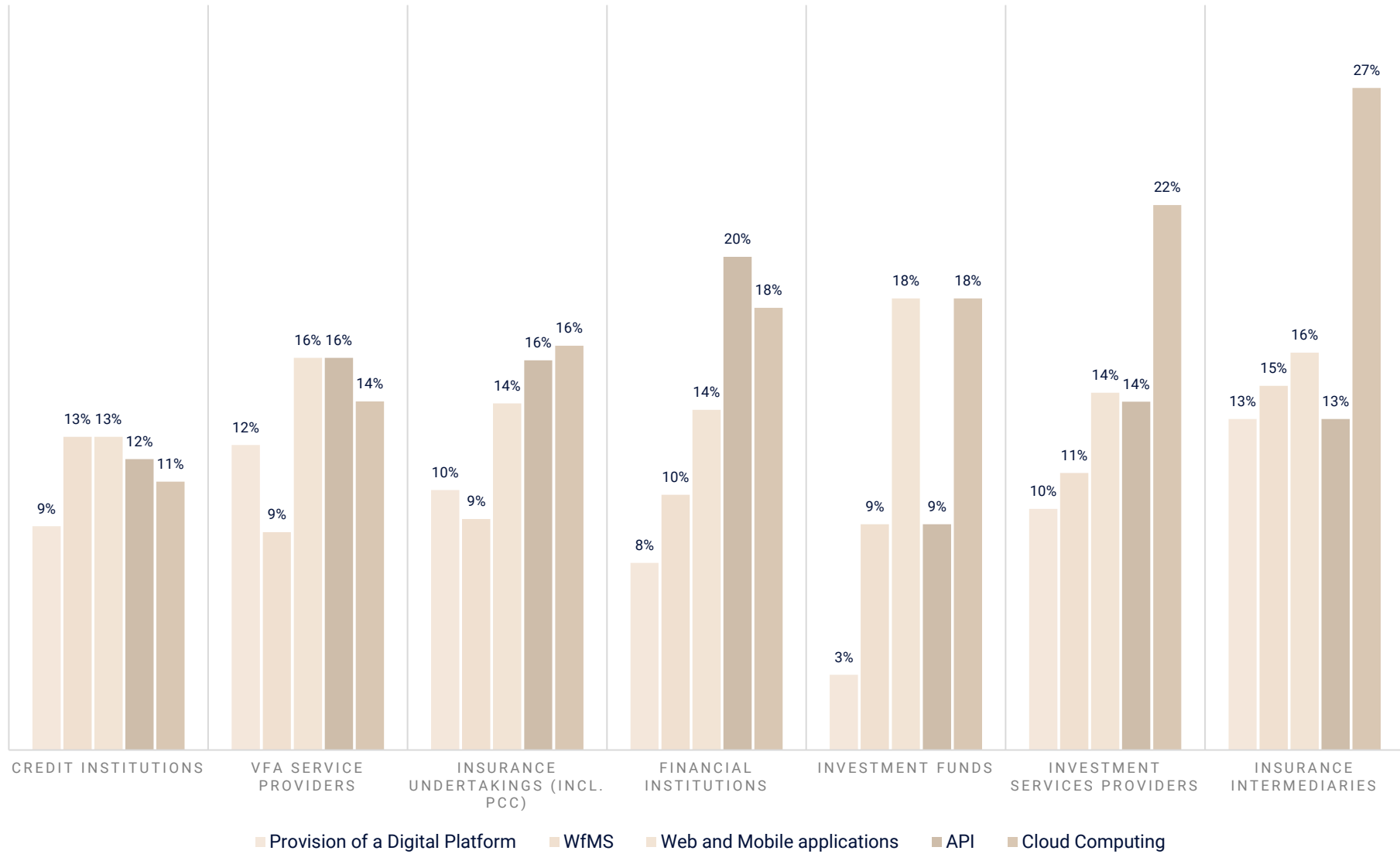
FIGURE 5.2 | TOP 5 ENABLING TECHNOLOGY ADOPTED BASED ON DTSS ACROSS SECTORS AS AT END 2021
*SOURCE | AUTHOR'S OWN SOURCES*

## 5.2 Distributed Ledger Technology

– DLT-based payment solutions (47%), clearing and settlement (40%), crypto-asset payments (33%), DeFi applications (27%), and data gathering, storage and documentation (20%) were the top 5 DLT-applications.
– From all Active APs that have DLT in their DTS, 57 per cent already utilised or provide DLT-based solutions for payment purposes.
– From all Active APs that have DLT in their DTS, 50% already deployed solutions for clearing and settlement, and data collection, storage and documentation in 2021.
– The DLT-based applications mostly expected deployment in 2022 are (i) the issuance of crypto-assets as a means of payments (60%), (ii) DeFi applications (50%), and (iii) solutions for payment purposes (43%).
– In terms of technological solution ownership, the top 3 DLT-based applications were fully developed and owned by the APs.

### 5.2.1 Applicability

Based on APs that adopt DLT in their DTSs, as illustrated in Figure 5.3, the top five DLT applications were in the areas of payment solutions (47%), clearing and settlement (40%), crypto payments (33%), DeFi applications (27%), and data gathering, storage and documentation (20%). The remaining DLT applications may be found in Table A3.2 within the Annex.

| DLT BASED SOLUTIONS FOR PAYMENTS PURPOSES | CLEARING AND SETTLEMENT | ISSUANCE OF CRYPTO ASSETS AS MEANS OF PAYMENTS | DEFI APPLICATIONS | DATA COLLECTION, SOTRAGE AND DOCUMENTATION |
|---|---|---|---|---|
| 47% | 40% | 33% | 27% | 20% |

FIGURE 5.3 | TOP 5 DLT APPLICATIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.2.2 Stage of Adoption

The stage of adoption for the top five DLT applications are presented in Figure 5.4. 50 per cent of APs that adopt DLT in their DTS note that they already used or provided DLT-based solutions with high business relevance for the purposes of information recording, data storage, or general documentation. Similarly, 50 per cent of APs that adopted DLT in their

solutions note that with basic relevance, they already used or provided DeFi applications. Also, 50 per cent of APs note that being inevitable for their business models, they already used or provided DLT based solutions for clearing and settlement purposes. The complete set of results pertaining to the adoption stage for DLT-based enabling and innovative technologies locally may be found in Table A3.3 within the Annex.

| | | | | | | |
|---|---|---|---|---|---|---|
| PROVISION OR USE OF DLT BASED SOLUTIONS FOR INFORMATION RECORDING OR DATA STRORAGE OR GENERAL DOCUMENTATION PURPOSES | 25% | | 50% | | | 25% |
| PROVISION OR USE OF DEFI APPLICATIONS | 17% | | 50% | | | 33% |
| PROVISION OR USE OF DLT BASED SOLUTIONS FOR CLEARING AND SETTLEMENT PURPOSES | 17% | 17% | 50% | | | 17% |
| DLT BASED SOLUTIONS FOR PAYMENT PURPOSES | 14% | 14% | 14% | 14% | 14% | 29% |
| ISSUANCE OF CRYPTO ASSETS AS MEANS OF PAYMENTS | 20% | 20% | 20% | 20% | 20% | |

- ■ In exploration phase
- ■ In development phase
- ■ In testing phase
- ■ Already in use, inevitable for business model
- ■ Already in use, with high business relevance
- ■ Already in use, with basic business relevance
- ■ Already in use, but low business relevance
- ■ No information available

FIGURE 5.4 | TOP 5 DLT APPLICATIONS - STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

From Active APs that adopted DLT in their DTSs, 57 per cent already make use or provide DLT-based solutions for payment purposes. From Table A3.3, 29 per cent of APs note that the use or provision of DLT-based solutions for payments purposes have low relevance for their business, and 14 per cent with basic and inevitable business relevance. Also, 14 per cent of APs that adopt DLT in their solutions were currently in exploration, development, and testing phases.

### 5.2.3 Time of Deployment

In terms of deployment, 50 per cent of APs note that the provision or use of DLT-based solutions for (i) clearing and settlement, and (ii) information recording, data storage, or general documentation purposes were deployed as at end 2021. Similarly, 67 per cent of APs note that DLT-based solutions for communication purposes were adopted as at end 2021. Meanwhile during 2022, it was expected that APs deploy applications focusing on (i) the issuance of crypto-assets as a means of payments (60%); (ii) DeFi (50%) and payment purposes (43%).
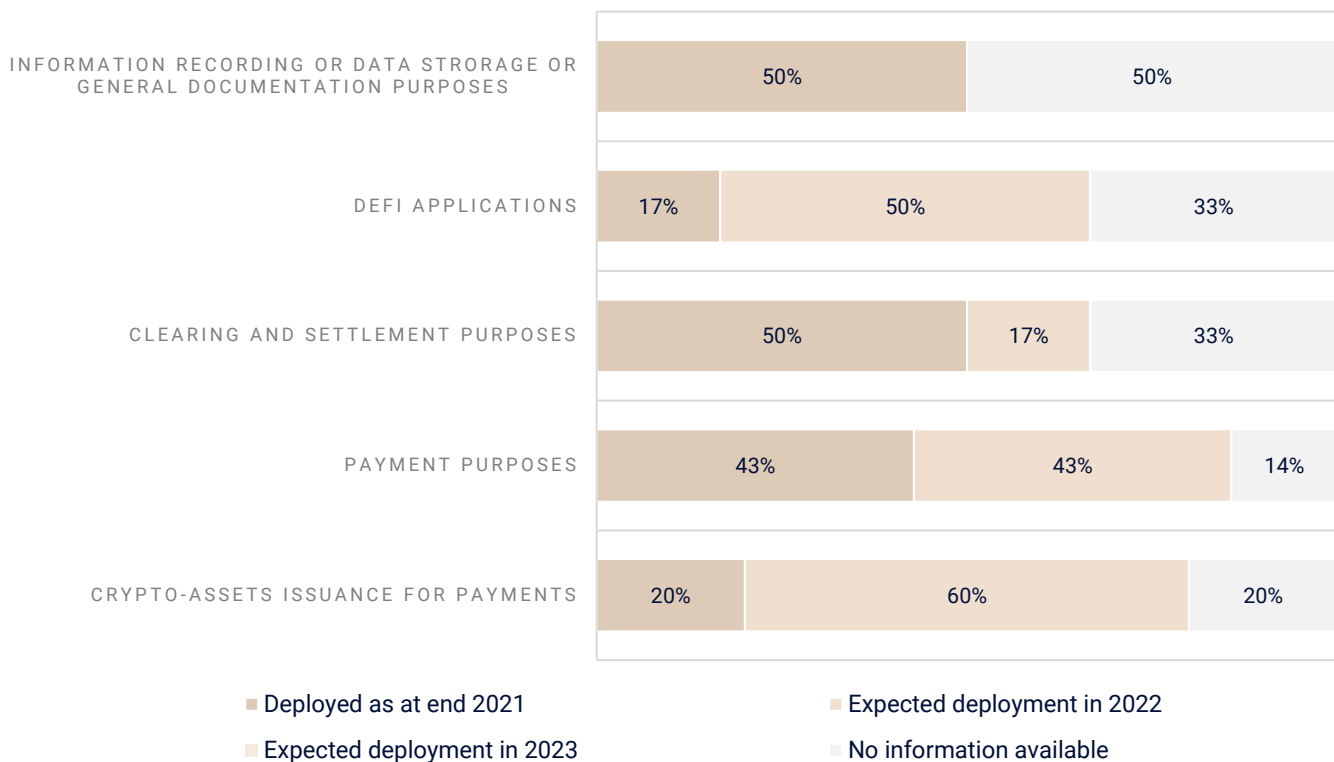


FIGURE 5.5 | TOP 5 DLT APPLICATIONS - TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.2.4 Ownership of Technological Solutions

Figure 5.6 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. It is evident that the majority of APs who have adopted the top five applications have developed these internally, especially in terms of (i) issuance of crypto-assets as means of payments, (ii) DLT-based solutions for payments, and (iii) DLT-based solutions for clearing and settlement purposes, which were completely developed and owned by the APs. The remaining set of results pertaining to the ownership of technological solutions may be found in Table A3.5 within the Annex.
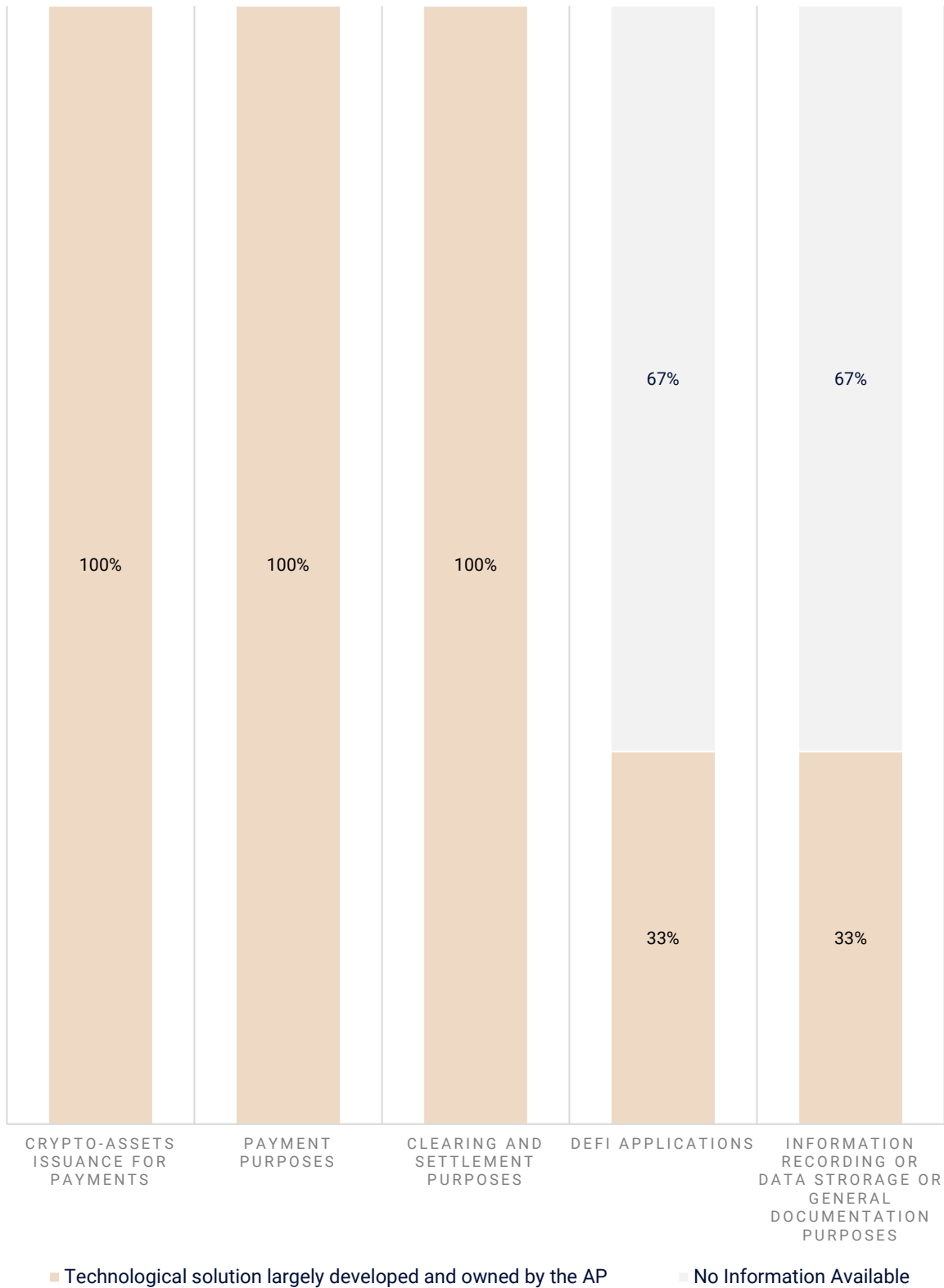
FIGURE 5.6 | TOP 5 DLT APPLICATIONS - OWNERSHIP OF TECHNOLOGICAL SOLUTIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.3 Artificial Intelligence and Machine Learning

- Chatbots and virtual assistants (49%), cybercrime (44%), AML (42%), operational efficiency (38%), and fraud detection (38%) were the top 5 AI and ML applications.
- From APs that adopted AI and ML in their DTSs, 42% already utilise chatbots and virtual assistants.
- From APs that adopted AI and ML in their DTS, 70% already deployed solutions for cybercrime detection and prevention in 2021.
- The applications mostly expected deployment are AI for operational efficiency (16%) in 2022, AML prevention and detection (13%) in 2023, and chatbots and virtual assistants (16%) in 2024.
- In terms of technological solution ownership, the top 5 AI and ML applications were mainly either fully bought from or used via partnership with third-party providers.

### 5.3.1 Applicability

Based on APs that adopt AI and ML in their DTSs, the top five applications are chatbots and virtual assistants (49%), cybercrime prevention and detection (44%), AML prevention and detection (42%), operational efficiency (38%), and fraud prevention and detection (38%) as presented in Figure 5.7. The remaining applications of AI and ML may be found in Table A3.6 within the Annex.



| CHATBOTS AND VIRTUAL ASSISTANTS | CYBERCRIME PREVENTION AND DETECTION | AML PREVENTION AND DETECTION | AI FOR OPERATIONAL EFFICIENCY | FRAUD PREVENTION AND DETECTION |
|---|---|---|---|---|
| 49% | 44% | 42% | 38% | 38% |
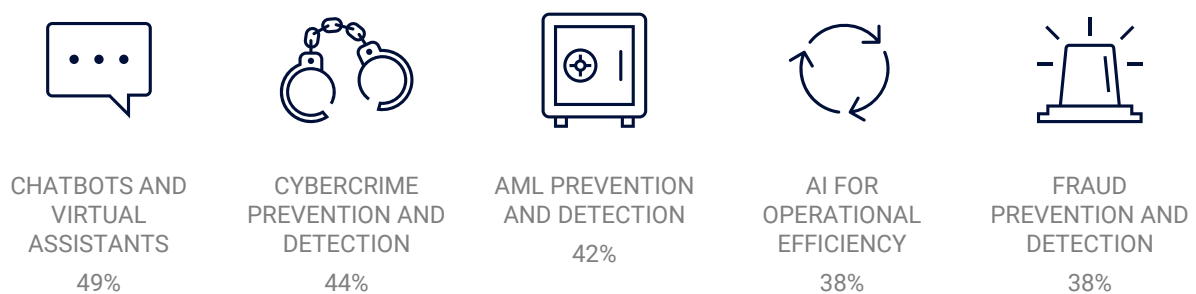
FIGURE 5.7 | TOP 5 AI and ML APPLICATIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.3.2 Stage of Adoption

The stage of adoption of the top five AI and ML applications are presented in Figure 5.8. The AI and ML applications identified by APs which were mostly already used include cybercrime prevention and detection (74%), KYC Client authentication and identification (63%), and AML prevention and detection (61%). 26 per cent of APs that already used AI and ML for the prevention and detection of AML, fraud and cybercrime considered it as inevitable for their

business models. Also, 26 per cent of APs considered the use of AI for operational efficiency and cybercrime prevention and detection with high business relevance, while 15 per cent of APs identify chatbots and virtual assistants with low business relevance. Table A3.7 within the Annex includes the entire set of results pertaining to the adoption stage for every AI and ML application.



- In Exploration Phase
- In Testing Phase
- Already in use, with high business relevance
- Already in use, but low business relevance

- In Development Phase
- Already in use, inevitable for business model
- Already in use, with basic business relevance
- No Information Available

FIGURE 5.8 | TOP 5 AI and ML APPLICATIONS - STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.3.3 Time of Deployment

Following the top five AI and ML applicable technologies presented in Figure 5.7, Figure 5.9 depicts their time of deployment. From Figure 5.9, it is evident that most of the adoption across all the top five applications of AI and ML occurred during 2021, with the highest AI and ML for cybercrime detection and prevention being the highest at 70 per cent.

Notably, another 16 per cent of APs note that the use of AI for operational efficiency is expected deployment in 2022, and a further 16 per cent of APs expect deployment of chatbots and virtual assistants in 2024. Similarly, 14 per cent of APs expect deployment of fraud detection and prevention in 2024. Table A3.8 within the Annex includes the deployment time for the remaining AI and ML applications.
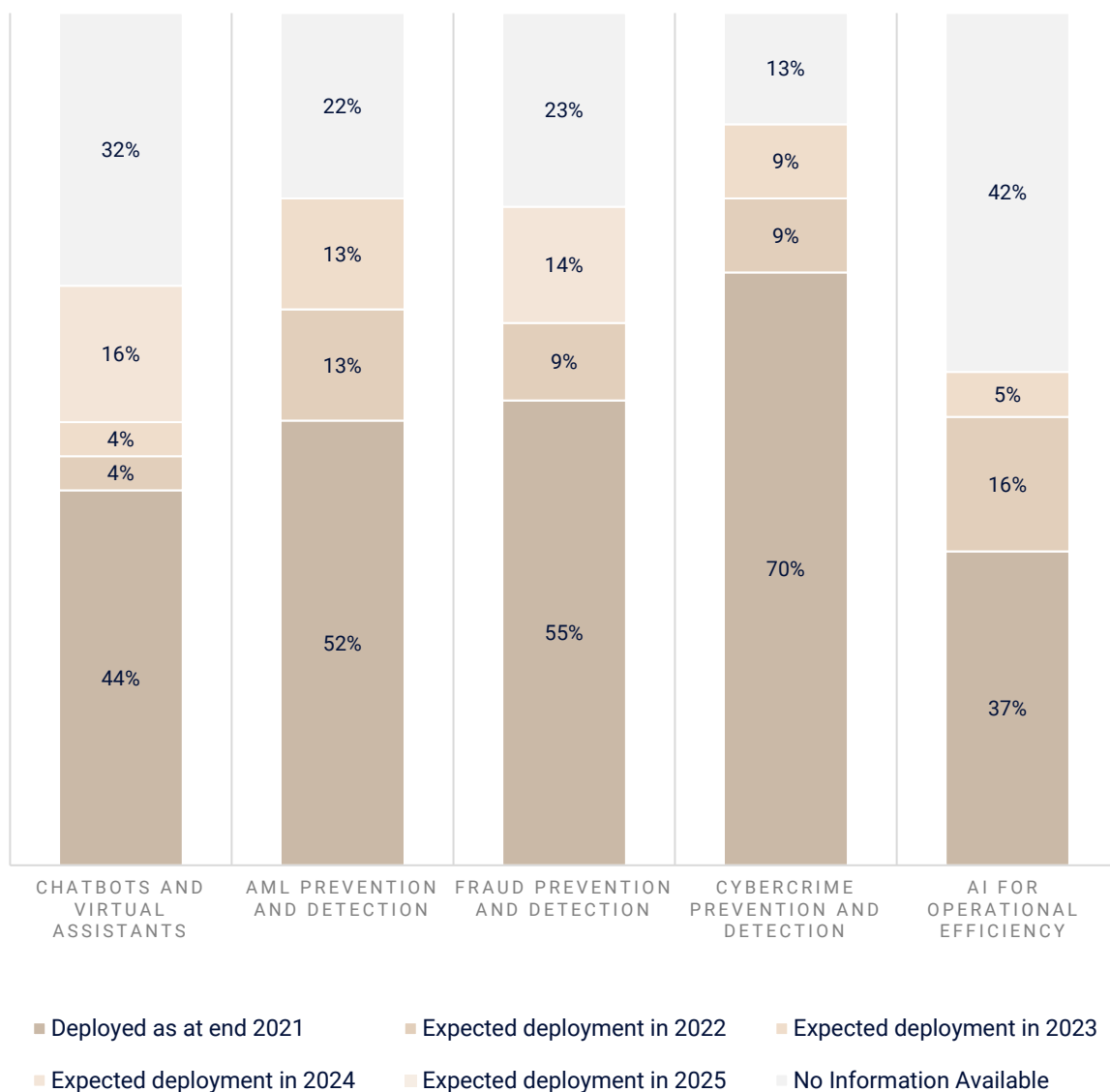


FIGURE 5.9 | TOP 5 AI and ML APPLICATIONS - TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.3.4 Ownership of Technological Solutions

Figure 5.10 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. From Figure 5.10, 40 per cent of APs note that their chatbots and virtual assistant solutions were completely bought from third-party providers. With respect to the use of AI for operational efficiency, 21 per cent of APs note that their technological solutions are largely developed and owned by themselves. For cybercrime detection and prevention, 43 per cent of APs note that their technological solution is used via partnership with third-party providers. The remaining set of results pertaining to the ownership of technological solutions may be found in Table A3.9 within the Annex.
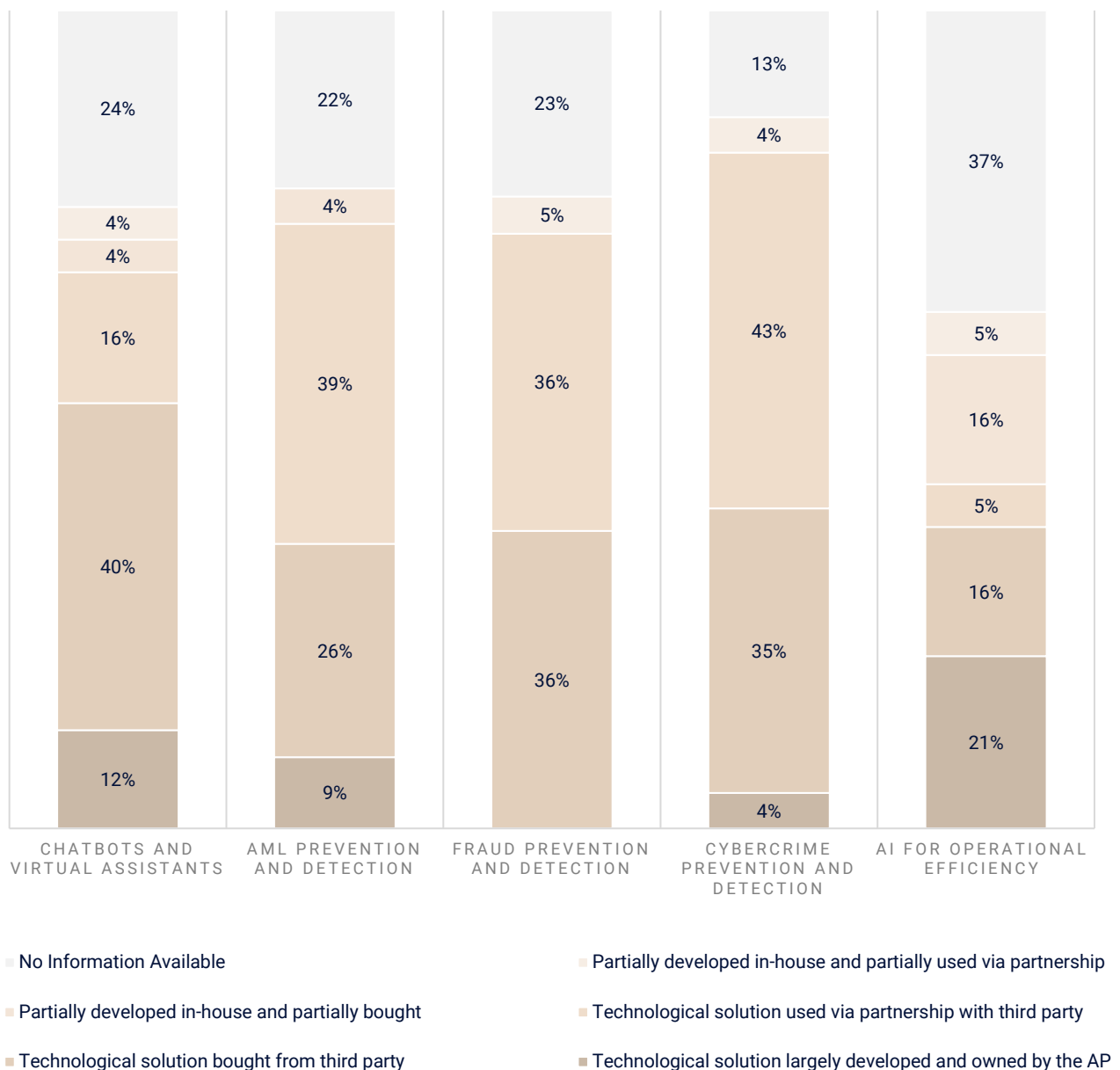


FIGURE 5.10 | TOP 5 AI and ML APPLICATIONS - OWNERSHIP
*SOURCE | AUTHOR'S OWN SOURCES*

## 5.4 Application Programme Interfaces

- Regulatory compliance, fraud and risk reduction (66%), payment services (61%), account information services (52%), facilitation of other services provided by APs (45%), and provision of an interface to connect customers and service providers (42%) were the top 5 applications of APIs.
- From APs that adopted API in their DTSs, 69% already utilise APIs for regulatory compliance, fraud, and risk reduction.
- From APs that adopted API in their DTSs, 79% already deployed solutions for account information related services in 2021.
- The API applications mostly expected deployment are regulatory compliance, fraud and risk reduction (13%) in 2022, payment related services (12%) in 2023, and the provision of an interface to connect customers and service providers (16%) in 2024.
- For the top 5 API applications, there was a mix between the ownership of the technological solutions, whether developed internally or obtained from third-party providers.

### 5.4.1 Applicability

Based on APs that adopt APIs in their DTSs, the top five applications are regulatory compliance, fraud, and risk reduction (66%), payment related services (61%), account information related services (52%), facilitation of other services provided by APs (45%), and provision of an interface and connecting customers and service providers (42%) as presented in Figure 5.11. The remaining API applications may be found in Figure A3.10 within the Annex.

| REGULATORY COMPLIANCE, FRAUD AND RISK REDUCTION | PAYMENT RELATED SERVICES | ACCOUNT INFORMATION RELATED SERVICES | FACILITATE USE OF OTHER SERVICES PROVIDED BY THE AP | PROVISION OF AN INTERFACE, CONNECTING CUSTOMERS AND SERVICE PROVIDERS |
|---|---|---|---|---|
| 66% | 61% | 52% | 45% | 38% |
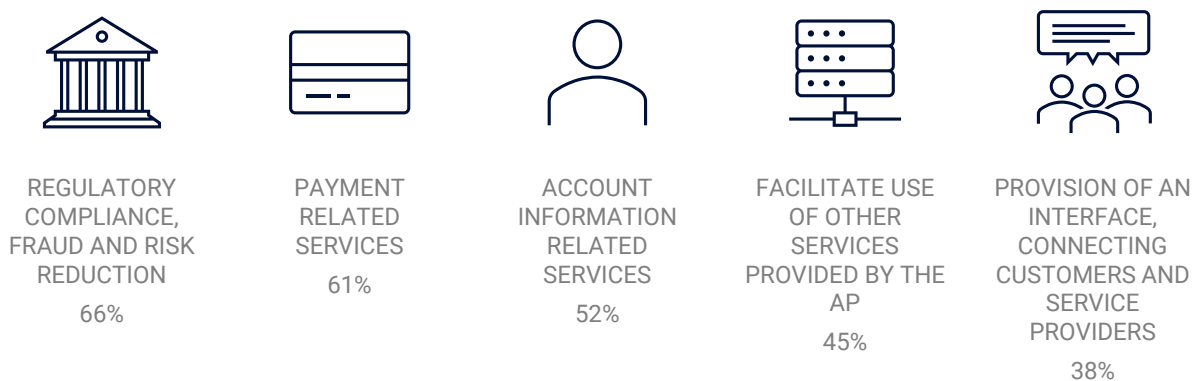
FIGURE 5.11 | TOP 5 API APPLICATIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.4.2 Stage of Adoption

The stage of adoption for the top five API applications are presented in Figure 5.12. The API applications identified by APs which were mostly already provided or used include services related to account information (82%), payments (72%), and the facilitation of other services by APs to their clients (70%). 33 per cent of APs that already used APIs for regulatory compliance, fraud and risk reduction considered it as inevitable for their business models. With respect to the provision or use of APIs for account information related services, 26 per cent of APs considered it with high business relevance, while a contrasting 20 per cent of APs considered it with low business relevance. Table A3.11 within the Annex includes the entire set of results pertaining to the adoption stage for every API application.



- In Exploration Phase
- In Development Phase
- In Testing Phase
- Already in use, but low business relevance
- Already in use, with basic business relevance
- Already in use, with high business relevance
- Already in use, inevitable for business model
- No Information Available

FIGURE 5.12 | TOP 5 API APPLICATIONS – STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.4.3   Time of Deployment

Figure 5.13 depicts their time of deployment. From Figure 5.13, 79 per cent of APs note that the use of API for account information related services was deployed as at end 2021. Similarly, 66 per cent of APs note that the use of APIs for (i) payment related services, (ii) regulatory compliance, fraud, and risk reduction and (iii) the facilitation to use other services provided by the AP to its clients were already deployed during 2021. Also, 13 per cent of APs note that the use of API for regulatory compliance, fraud and risk reduction expect deployment in 2022. From Figure 5.13, 12 per cent of APs expected deployment of APIs for payment related services in 2023, while five per cent of APs expect deployment of APIs for the facilitation to use other services provided by the AP to its clients in 2024.



FIGURE 5.13 | TOP 5 API APPLICATIONS – TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.4.4 Ownership of Technological Solution

Figure 5.14 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. It is apparent that most APs seek in varying capacity the use of third-party technology providers in developing their solutions. This notwithstanding, serval APs have indicated that they adopted (i) account information related services (45%); (ii) facilitate services provided by the AP to the clients (44%); and (iii) payment related service (37%) develop their solution largely in house and own the solution.



PAYMENT RELATED SERVICES
- 10%
- 8%
- 11%
- 19%
- 15%
- 37%

ACCOUNT INFORMATION RELATED SERVICES
- 6%
- 11%
- 6%
- 14%
- 18%
- 45%

FACILITATE SERVICES PROVIDED BY THE AP TO THE CLIENTS
- 16%
- 8%
- 5%
- 15%
- 11%
- 44%

INTERFACE CONNECTING CUSTOMERS AND SERVICE PROVIDERS
- 21%
- 9%
- 5%
- 21%
- 17%
- 28%

REGULATORY COMPLIANCE, FRAUD AND RISK REDUCTION
- 13%
- 10%
- 14%
- 18%
- 33%
- 12%

Legend:
- No Information Available
- Partially developed in-house and partially used via partnership
- Partially developed in-house and partially bought
- Technological solution used via partnership with third party
- Technological solution bought from third party
- Technological solution largely developed and owned by the AP

FIGURE 5.14 | TOP 5 API APPLICATIONS – OWNERSHIP
*SOURCE | AUTHOR'S OWN SOURCES*

## 5.5 Digital Identity, Biometrics, and Sensors

- The top five digital identity, biometric, and sensor applications were digital signatures (74%), face biometrics (67%), fingerprint or palmprint biometrics (54%), self-sovereign identity (26%), and temperature sensors (13%).
- From APs that adopted digital identities in their DTSs, 68% already utilised digital signatures.
- From APs that adopted biometrics in their DTS, 70% already deployed fingerprint or palmprint biometrics in 2021.
- The API applications mostly expected deployment are self-sovereign identities (36%) in 2022, and digital signatures (23%) in 2023.
- In terms of technological solution ownership, the top 5 digital identity, biometric, and sensor applications were mainly either fully bought from or used via partnership with third-party providers.

### 5.5.1 Applicability

Based on APs that adopt DBS in their DTSs, the top five applications were digital signatures (74%), face biometrics (67%), fingerprint or palmprint biometrics (54%), self-sovereign identity (26%), and temperature sensors (13%) as presented in Figure 5.15. The remaining DBS applications may be found in Table A3.14 within the Annex.

| DIGITAL IDENTITY \| DIGITAL SIGNITURES | BIOMETRICS \| FACE | BIOMETRICS \| FINGERPRINT AND PALMPRINT | DIGITAL IDENTITY \| SELF-SOVEREIGN IDENTITY | SENSORS \| TEMPERATURE |
|---|---|---|---|---|
| 74% | 67% | 54% | 26% | 13% |
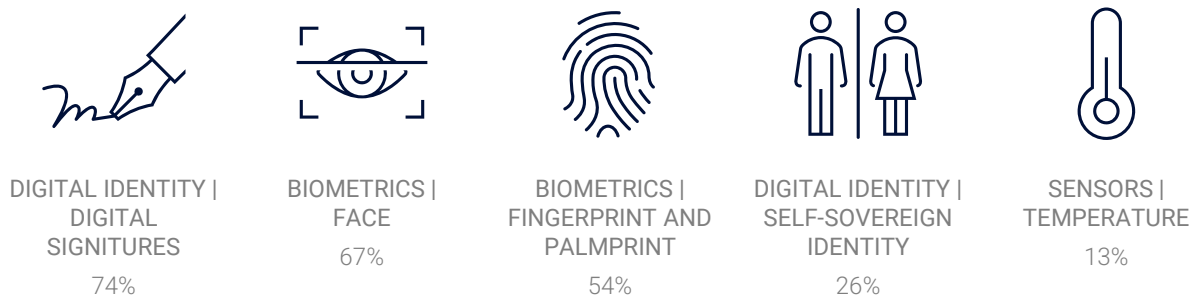
FIGURE 5.15 | TOP 5 DBS APPLICATIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.5.2 Stage of Adoption

The adoption stage for the top five DBS applications are presented in Figure 5.16. The DBS applications identified by APs which were mostly already used include fingerprint and palmprint (82%), face biometrics (68%), and digital signatures (68%). 19 per cent of APs that already utilised face biometrics considered it as inevitable for their business models. Also, 32 per cent of APs that already used digital signatures considered it with high business relevance. With respect to the use of fingerprint and palmprint, 32 per cent of APs consider it with basic

business relevance, while 11 per cent with low business relevance. Table A3.15 within the Annex includes the entire set of results pertaining to the adoption stage for every DBS application.
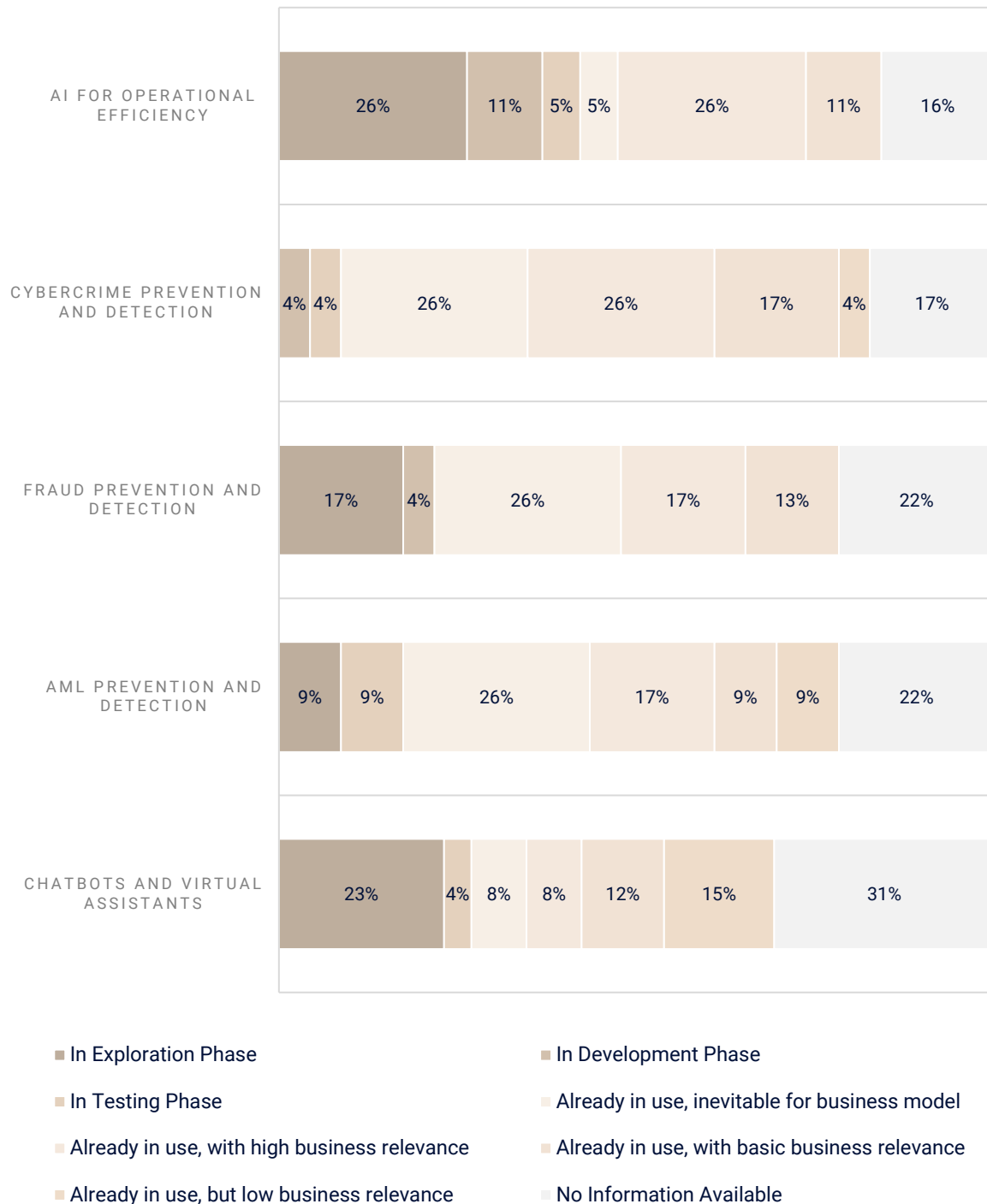


**In Exploration Phase**
**In Development Phase**
**In Testing Phase**
**Already in use, but low business relevance**
**Already in use, with basic business relevance**
**Already in use, with high business relevance**
**Already in use, inevitable for business model**
**No Information Available**
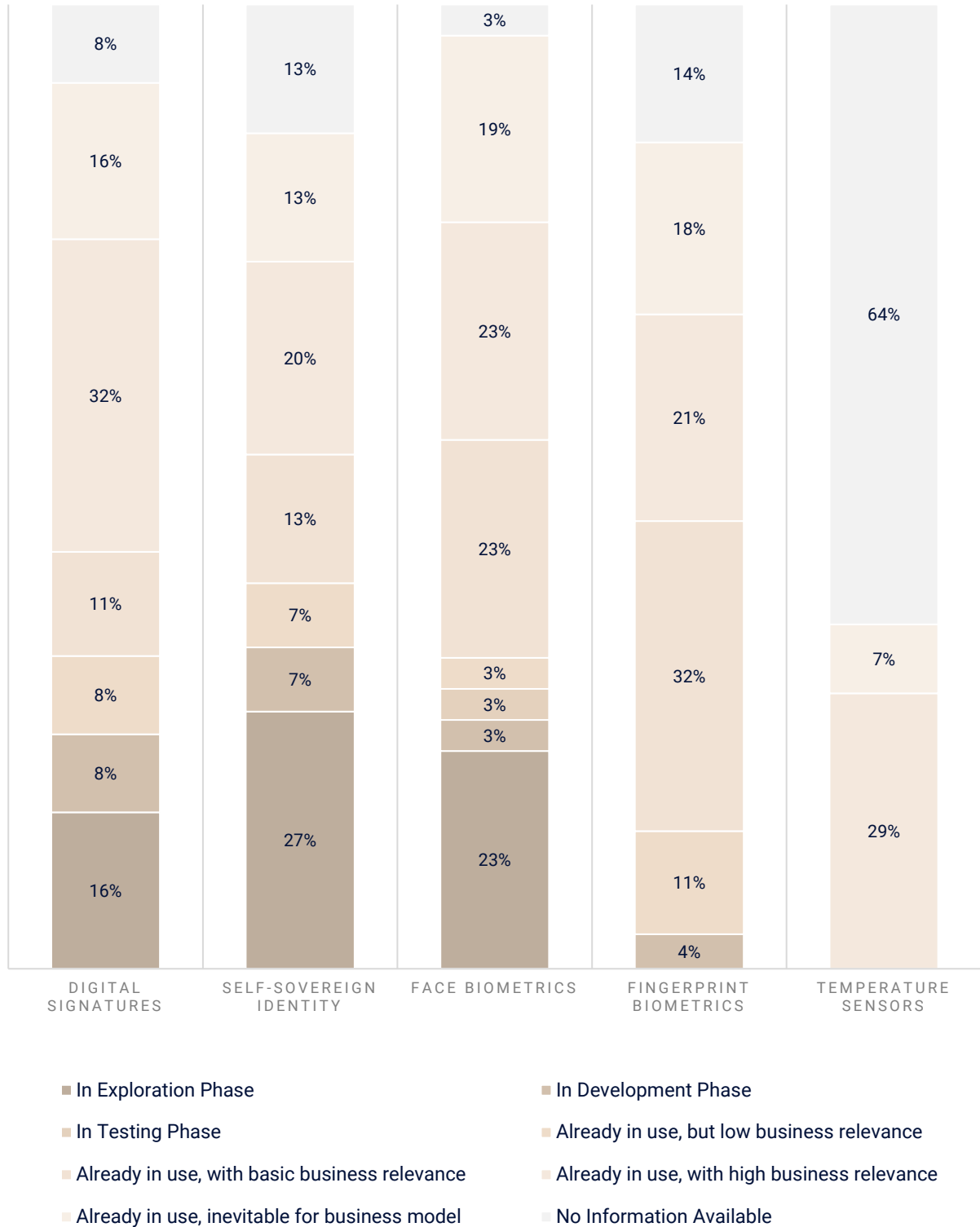
FIGURE 5.16 | TOP 5 DBS APPLICATIONS – STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.5.3  Time of Deployment

Following the top five technologies adopted in terms of DBS presented in Figure 5.15, Figure 5.17 depicts their time of deployment. From Figure 5.17, 70 per cent of APs note that fingerprint and palmprint biometrics were already deployed as at end 2021. Similarly, 29 per cent of APs note that the use of self-sovereign digital identities was already deployed during 2021. However, 36 per cent of APs expect deployment of the same technology during 2022. From Figure 5.17, 23 per cent of APs expect deployment of digital signatures during the year 2023, while no APs reported expected deployment of DBS, and sensors overall for the years 2024 and 2025.
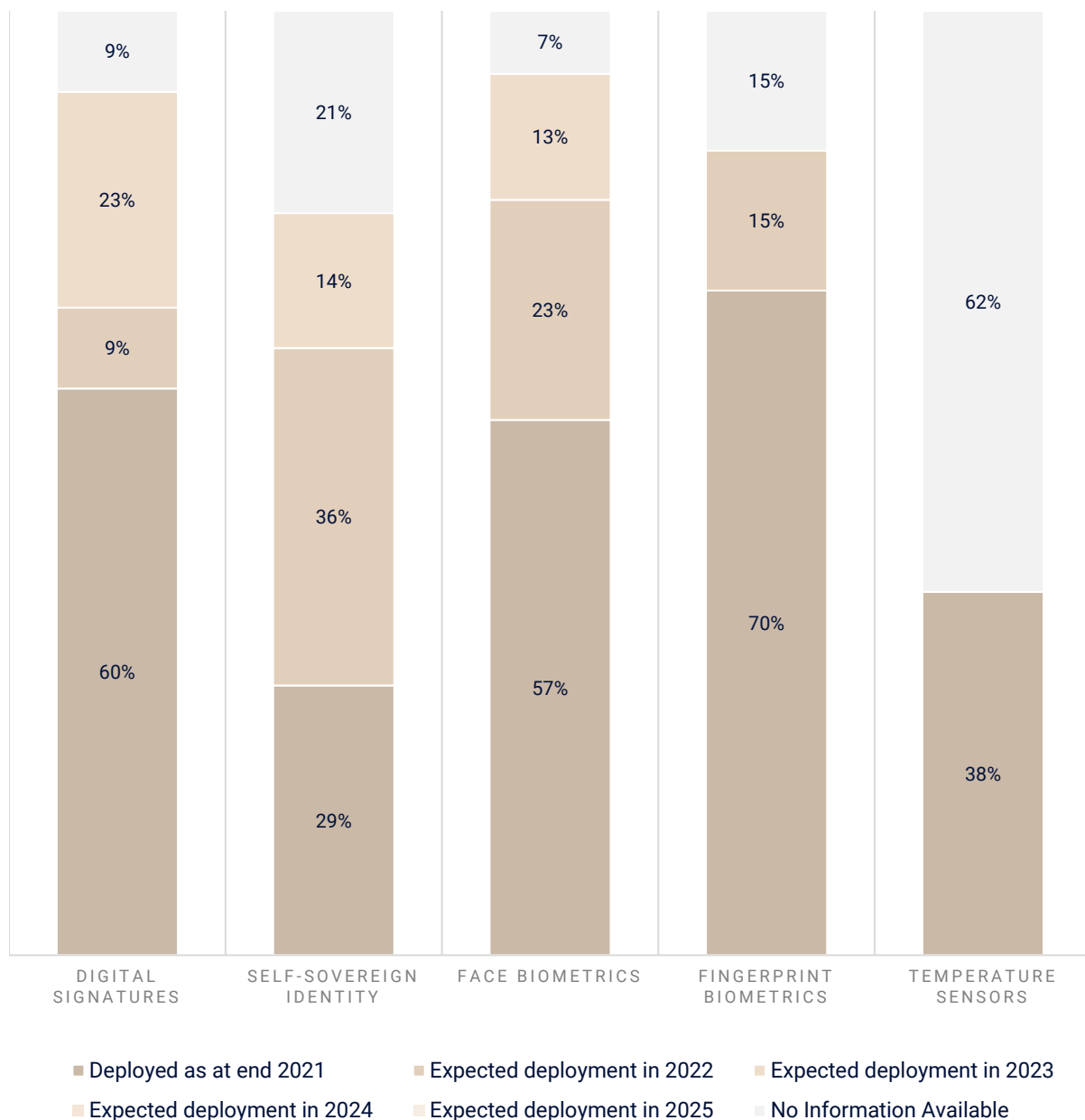


FIGURE 5.17 | TOP 5 DBS APPLICATIONS – TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.5.4 Ownership of Technological Solutions

Figure 5.18 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. From Figure 5.18, it is evident that the majority of APs use in varying degrees outsourced solutions. Indeed, 58 per cent of APs note that their digital signature solutions were completely bought from third-party providers. With respect to face biometrics, 23 per cent of APs note that their technological solutions were largely developed and owned by themselves. The remaining set of results pertaining to the deployment time and ownership of technological solutions may be found in Table A3.16 and Table A3.17 within the Annex, respectively.



| | | | |
|---|---|---|---|
| ■ No Information Available | | ■ Partially developed in-house and partially used via partnership | |
| ■ Partially developed in-house and partially bought | | ■ Technological solution used via partnership with third party | |
| ■ Technological solution bought from third party | | ■ Technological solution largely developed and owned by the AP | |
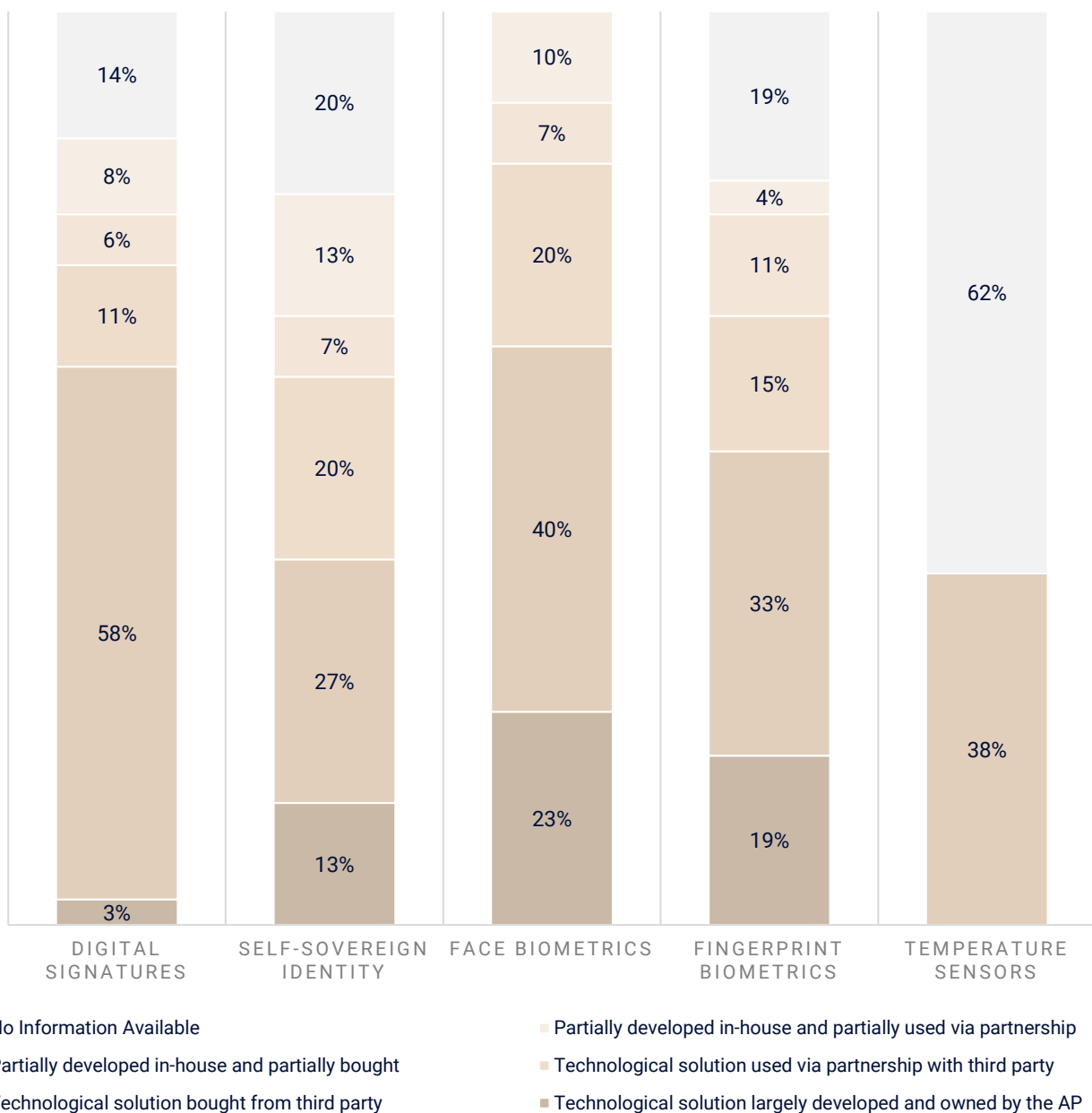
FIGURE 5.18 | TOP 5 DBS APPLICATIONS – OWNERSHIP
*SOURCE | AUTHOR'S OWN SOURCES*

## 5.6   Cloud Computing

**KEY OBSERVATIONS**

– The top five cloud computing applications were SaaS (77%), PaaS (49%) and IaaS (46%) for internal purposes, and SaaS for B2B (32%), and SaaS for B2C (23%),
– From APs that adopted cloud computing in their DTSs, 87% already utilised SaaS for internal purposes, and 76% already deployed it in 2021.
– The cloud computing applications mostly expected deployment are PaaS (10%) in 2022, SaaS for B2B and PaaS (6%) in 2023, and IaaS and PaaS (1%) in 2024.
– In terms of technological solution ownership, the top 5 cloud computing applications were mainly either fully bought from or used via partnership with third-party providers.
– The deployment models of the top five cloud computing applications mainly consist of public and private cloud.

### 5.6.1   Applicability

Based on APs that adopt cloud computing in their DTSs, the top five applications were the use of SaaS for internal purposes (77%), PaaS for internal purposes (49%), IaaS for internal purposes (46%), SaaS B2B (32%), and SaaS B2C (23%), as presented in Figure 5.19. The remaining cloud computing applications may be found in Table A3.18 within the Annex.



| SAAS FOR INERNAL PURPOSES | PAAS FOR INTERNAL PURPOSES | IAAS FOR INTERNAL PURPOSES | SAAS | B2B | SAAS | B2C |
| 77% | 49% | 46% | 32% | 23% |

FIGURE 5.19 | TOP 5 CLOUD COMPUTING APPLICATIONS
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.6.2   Stage of Adoption

The stage of adoption for the top five cloud computing applications are portrayed in Figure 5.20. The cloud computing applications identified by APs which were mostly already used internally include SaaS (87%), PaaS (73%), and IaaS (73%). From Figure 5.20, 43 per cent of APs that already internally used IaaS considered it as inevitable for their business models. Additionally, 39 per cent of APs considered the internal use of SaaS with high business relevance. Ten per cent of APs already used and considered PaaS and SaaS for B2C, and PaaS for internal purposes with basic business relevance. Also, six per cent of APs already used and considered SaaS for B2B, and SaaS and PaaS for internal purposes with low business

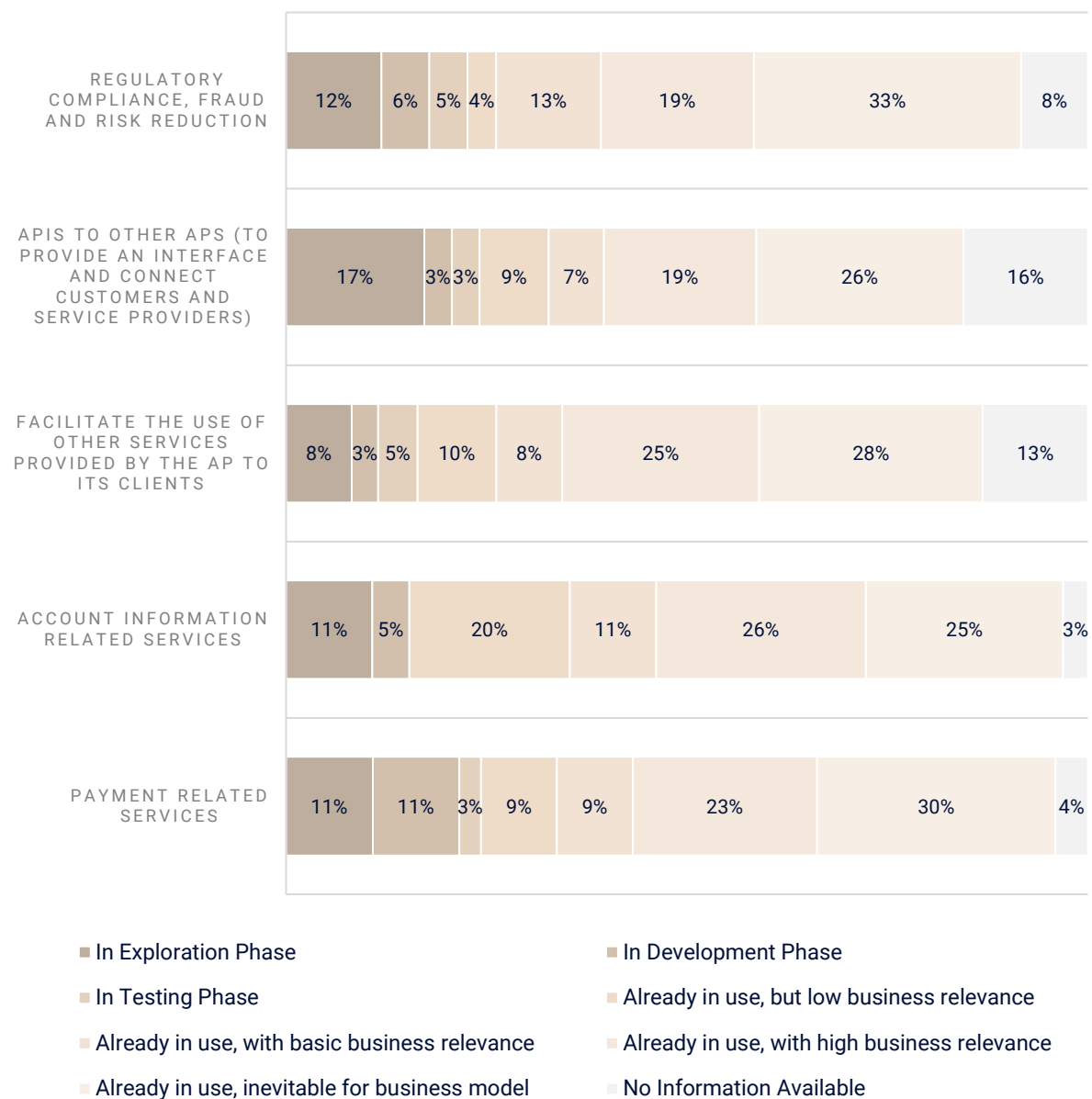relevance. Table A3.19 within the Annex includes the entire set of results pertaining to the adoption stage for every cloud computing application.
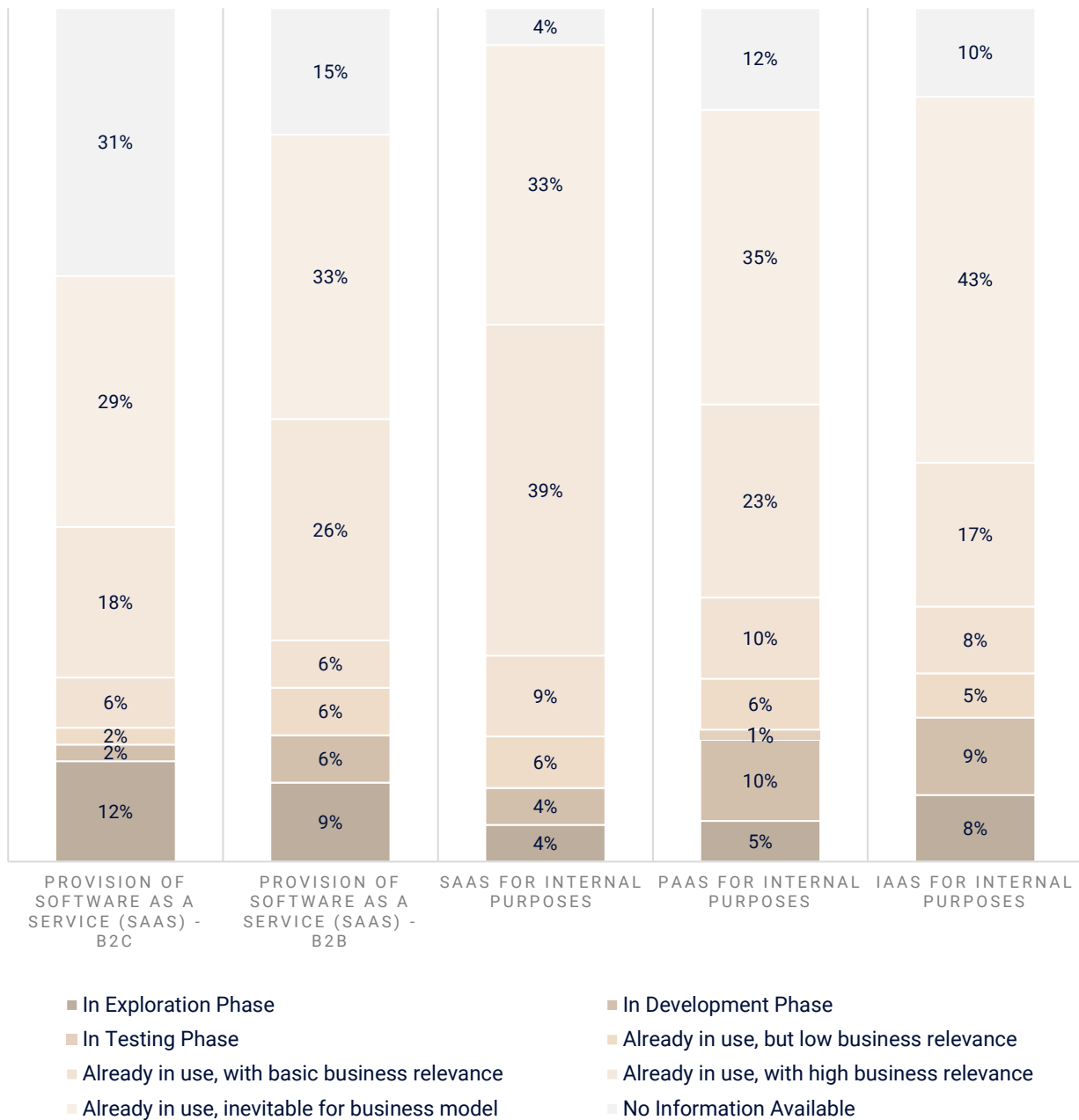


FIGURE 5.20 | TOP 5 CLOUD COMPUTING APPLICATIONS – STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.6.3   Time of Deployment

Following the top five technologies surrounding cloud computing presented in Figure 5.19, Figure 5.21 depicts their deployment time. From Figure 5.21, 76 per cent of APs note that the internal use of SaaS was already deployed as at end 2021. Similarly, 69 per cent of APs note that the use of IaaS was already deployed during 2021. However, nine per cent of APs expect deployment of the same technology during 2022. From Figure 5.21, six per cent of APs expect

deployment of SaaS for B2B during the year 2023. Furthermore, one per cent of APs expect deployment internally for PaaS and IaaS during the year 2024, while no APs reported that they expect deployment related to cloud computing technology during the year 2025.
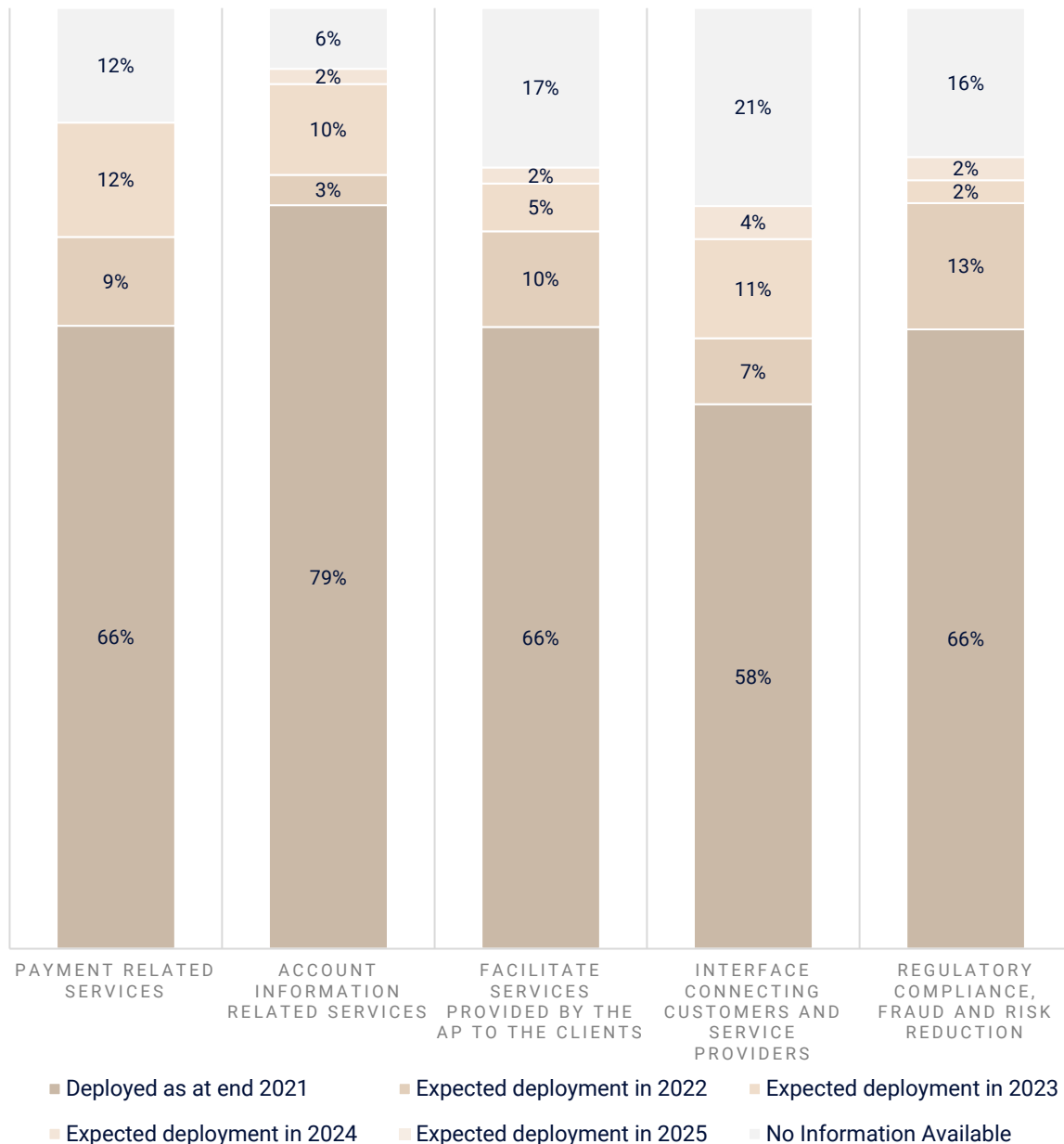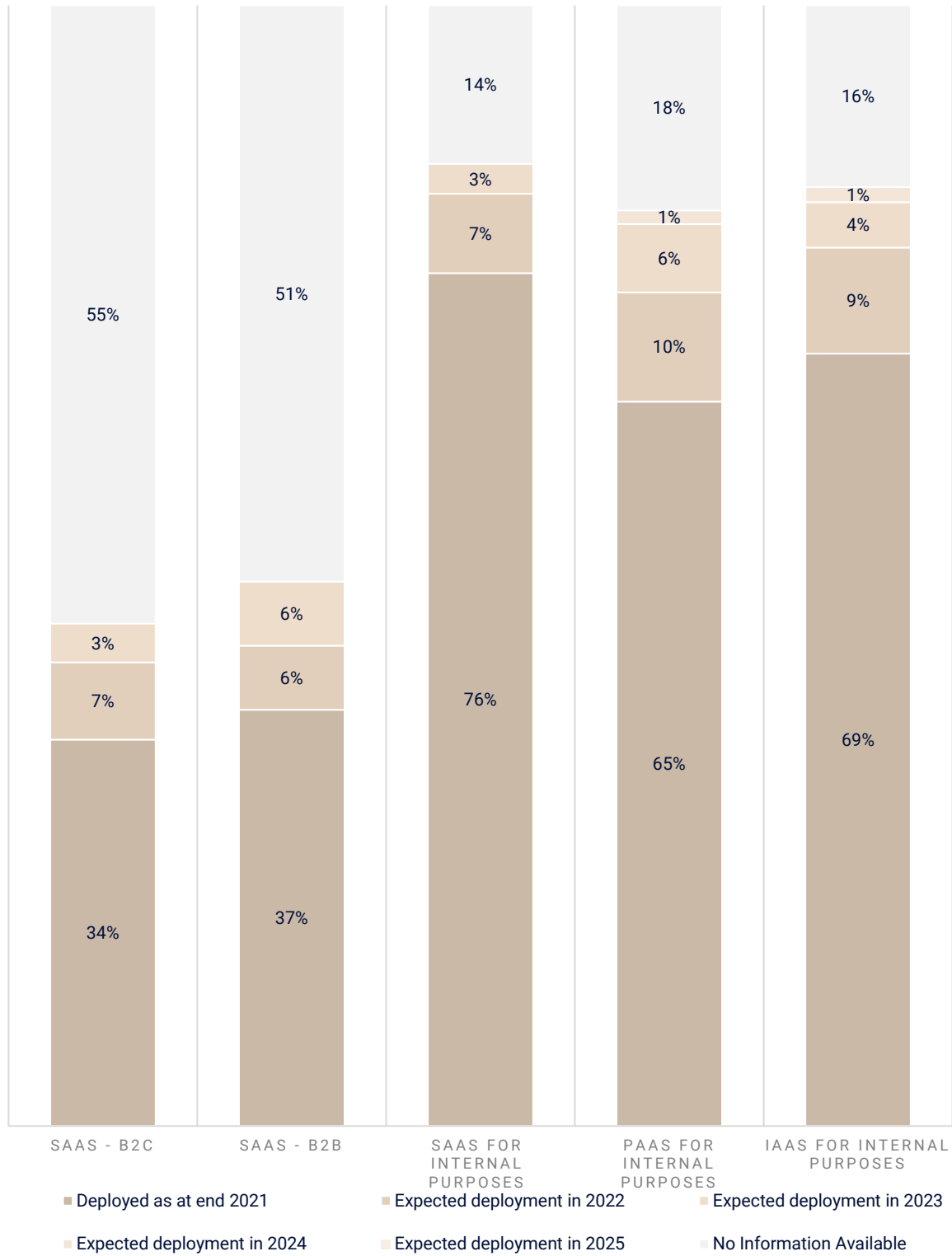


FIGURE 5.21 | TOP 5 CLOUD COMPUTING APPLICATIONS − TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.6.4   Ownership of Technological Solutions

Figure 5.22 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. From Figure 5.22, 53 per cent of APs note that their SaaS solutions utilised for internal use were completely bought from third-party providers. With respect to the use of IaaS internally, 12 per cent of APs note that their technological solutions were largely developed and owned by themselves. The remaining set of results pertaining to the deployment time and ownership of technological solutions may be found in Table A3.20 and Table A3.21 within the Annex, respectively.
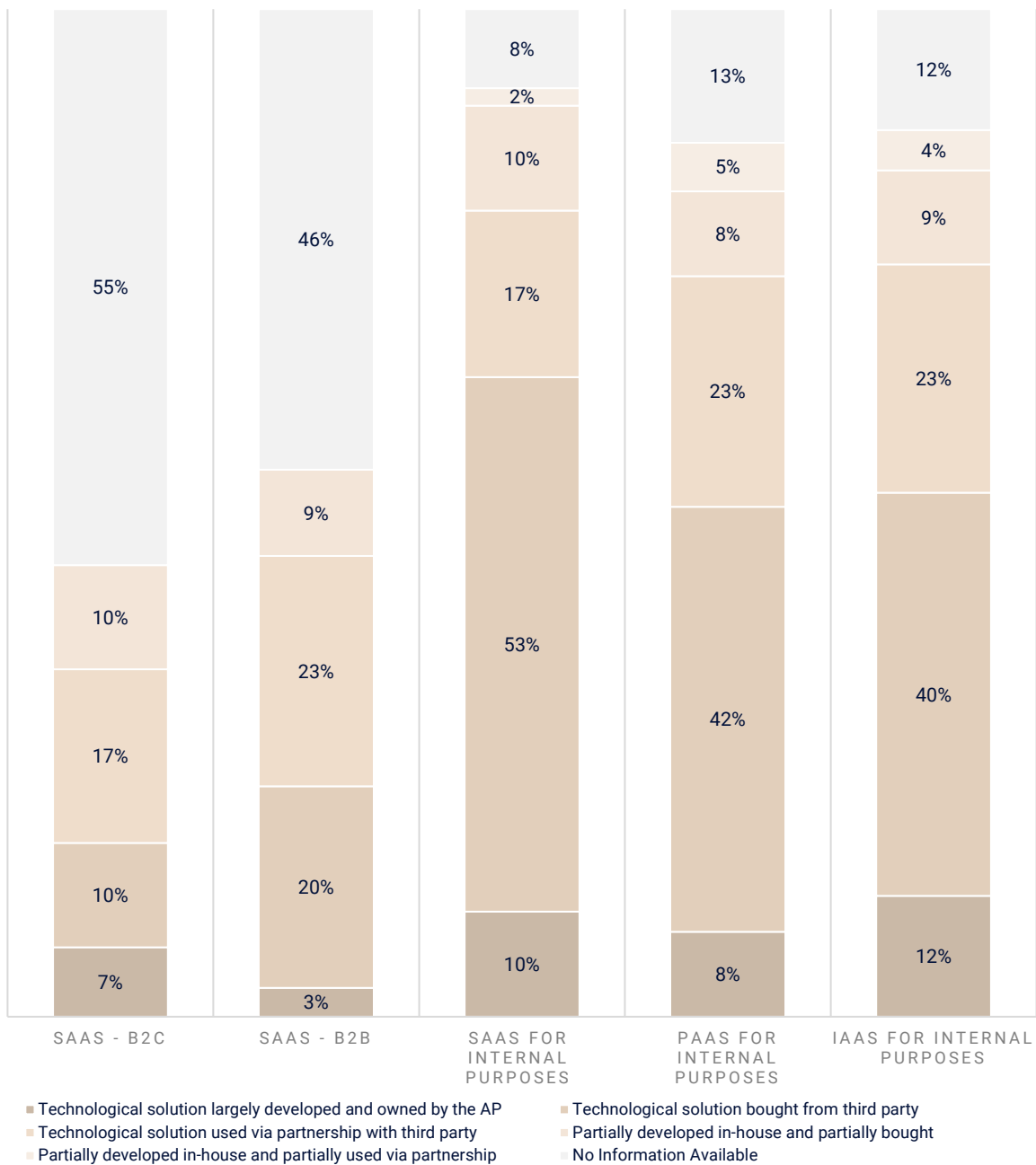


FIGURE 5.22 | TOP 5 CLOUD COMPUTING APPLICATIONS – OWNERSHIP
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.6.5 Deployment Models

Based on the APs DTS and the enabling technology adopted, Figure 5.23 presents information regarding the deployment models within the context of cloud computing for the top five applicable technologies from Figure 5.19. The different deployment models considered within the context of the FAS were namely private, community, public and hybrid cloud.

From Figure 5.23, APs note that the deployment model mostly attributed to the use of SaaS for internal purposes was private cloud, followed by a further 39 per cent as a public cloud for the reference year of 2021. Similarly, the deployment model mostly adopted for internal use of PaaS was public cloud. With regards to PaaS, one per cent of APs note the adoption of a community cloud, while another four per cent make use of hybrid clouds. The remaining set of results pertaining to the prevalent deployment models for cloud computing are found within the Annex.
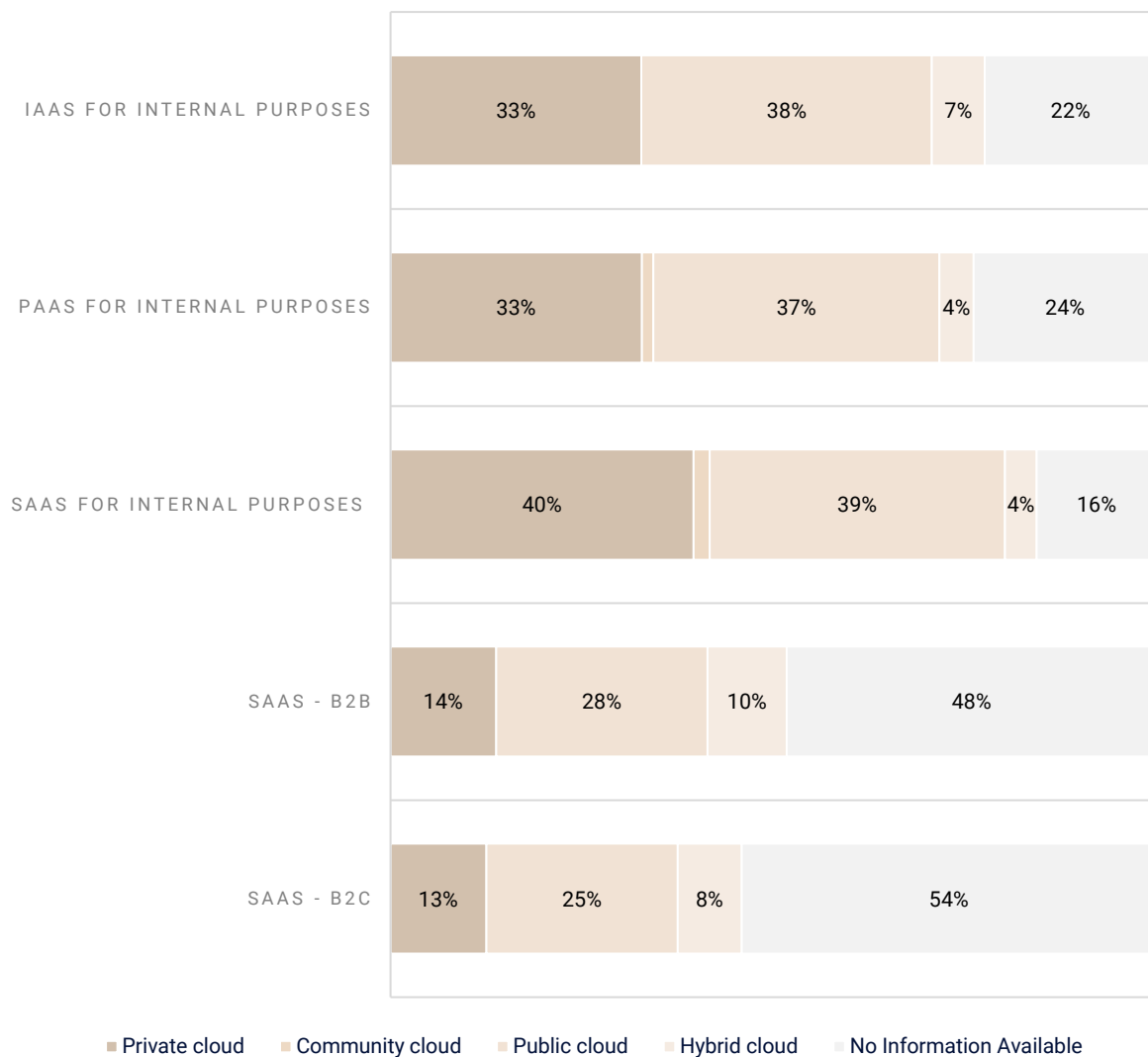


FIGURE 5.23 | TOP 5 CLOUD COMPUTING APPLICATIONS – PREVALENT DEPLOYMENT MODEL
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.7 Other Enabling Technologies

- Web and mobile applications (73%), WfMS (53%), big data and data analytics (45%), digital platforms (38%), and RPA (20%) were the top 5 other enabling technology applications.
- From APs that adopted web and mobile applications in their DTSs, 81% already utilise such technology, and 75% deployed it in 2021.
- The other enabling technology applications mostly expected deployment are digital platforms (14%) in 2022, WfMS (11%) in 2023, and big data and data analytics (8%) in 2024.
- For the top 5 other enabling technology applications, there was a mix between the ownership of the technological solutions, whether developed internally or obtained from third-party providers.

### 5.7.1 Applicability

Figure 5.24 presents the top five applications for other enabling technologies. From Figure 5.24, the top five other applications are web and mobile applications (73%), WfMS (53%), big data and analytics (45%), provision of a digital platform (38%), and RPA (20%). The applicability of other enabling technologies may be found in Table A3.23 within the Annex.



| Web and Mobile Applications | Workflow Management Systems | Big Data and Data Analytics | Provision of a Digital Platform | Robotic Process Automation |
| 73% | 53% | 45% | 38% | 20% |
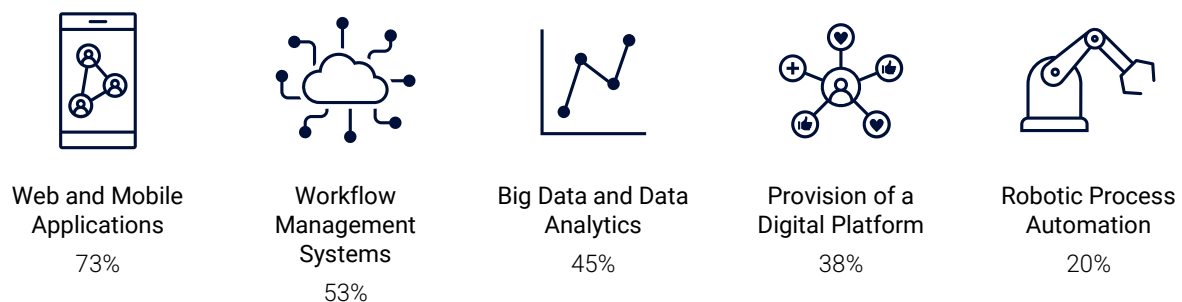
FIGURE 5.24 | TOP 5 OTHER ENABLING TECHNOLOGY - APPLICABILITY
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.7.2 Stage of Adoption

Building on the results presented in Figure 5.24, Figure 5.25 presents the adoption stage for the top five other enabling technology applications. According to APs, web and mobile applications (81%) were mostly already used, followed by WfMS (70%) and digital platforms (64%). From these figures, 32 per cent of APs that already used web and mobile applications considered it as inevitable for their business model. Also, 31 per cent of APs that already utilised big data and data analytics considered it with high business relevance. Furthermore, 19 per cent of APs already used and considered RPA with low business relevance. The results pertaining to adoption stage for the remaining other enabling technologies adopted locally may be found in Table A3.24 within the Annex.

Legend:

- In Exploration Phase
- In Testing Phase
- Already in use, with basic business relevance
- Already in use, inevitable for business model
- In Development Phase
- Already in use, but low business relevance
- Already in use, with high business relevance
- No Information Available
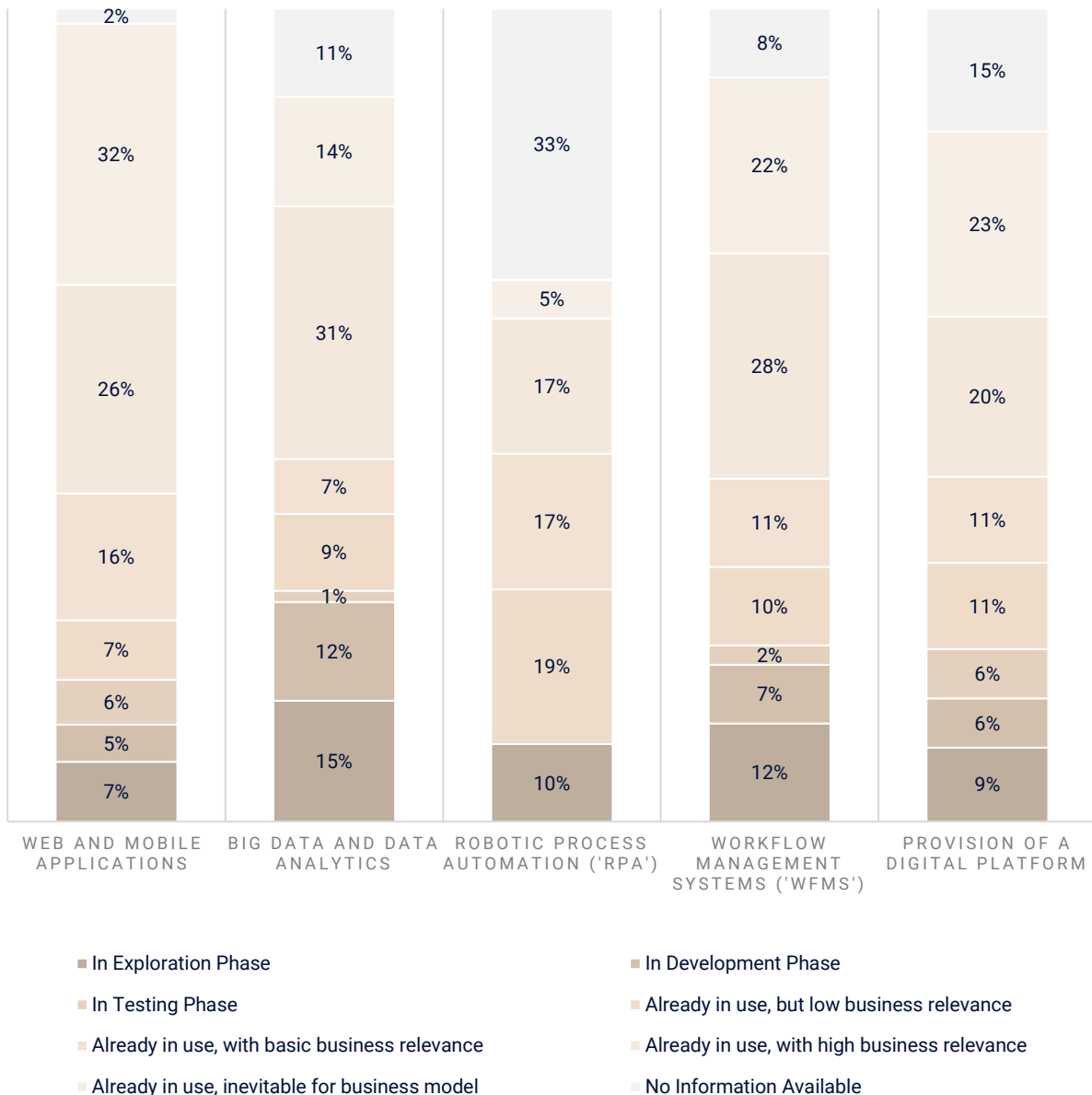
FIGURE 5.25 | TOP 5 OTHER ENABLING TECHNOLOGY – STAGE OF ADOPTION
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.7.3   Time of Deployment

Following the other top five enabling and innovative technologies presented in Figure 5.24, Figure 5.26 depicts their time of deployment. From Figure 5.26, 75 per cent and 65 per cent of APs note that they adopted web and mobile applications and WfMS as at end 2021, respectively. A further 14 per cent of APs expect deployment of digital platforms during 2022. From Figure 5.26, 11 per cent of APs expect deployment of WfMS and big data and data analytics during 2023. Furthermore, eight per cent of APs expect deployment of big data and data analytics during 2024, while no APs reported that they expect deployment related to any other technology during the 2025.
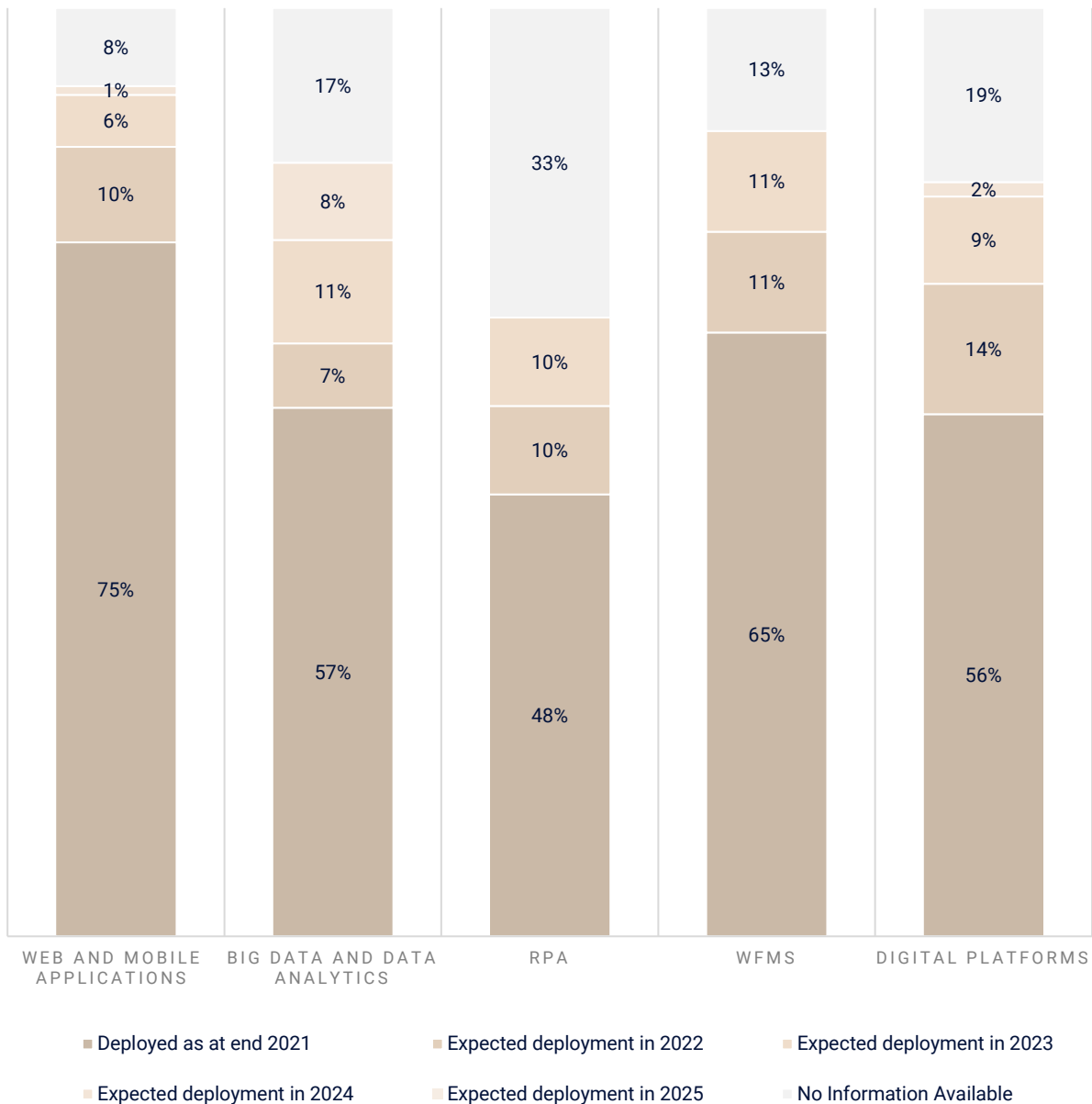
FIGURE 5.26 | TOP 5 OTHER ENABLING TECHNOLOGY – TIME OF DEPLOYMENT
*SOURCE | AUTHOR'S OWN SOURCES*

### 5.7.4 Ownership of Technological Solutions

Figure 5.27 presents the ownership of technological solutions, whether completely or partially developed internally, or obtained from third party service providers. From Figure 5.27, 39 per cent of APs note that their WfMS were completely bought from third-party providers. With respect to web and mobile applications, and big data and data analytics, 36 per cent of APs note that their technological solutions were largely developed and owned by themselves. The remaining set of results pertaining to the ownership of technological solutions are found within the Annex of the FAS.
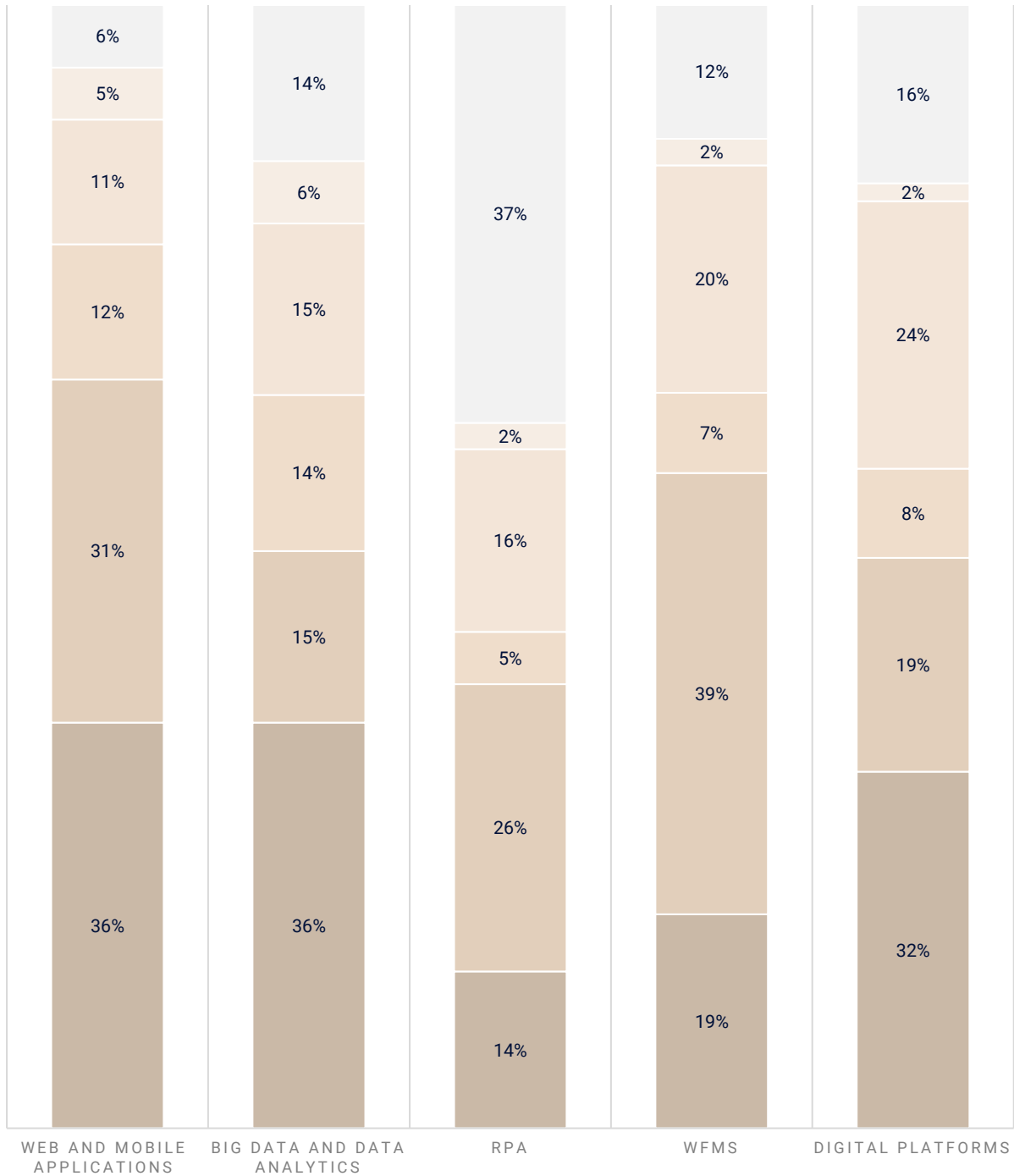
| | | | | |
|---|---|---|---|---|
| 6% | | | 12% | 16% |
| 5% | 14% | | 2% | 2% |
| 11% | 6% | 37% | 20% | 24% |
| 12% | 15% | | 7% | 8% |
| 31% | 14% | 2% | 39% | 19% |
| | 15% | 16% | | 32% |
| 36% | 36% | 5% | 19% | |
| | | 26% | | |
| | | 14% | | |

| WEB AND MOBILE APPLICATIONS | BIG DATA AND DATA ANALYTICS | RPA | WFMS | DIGITAL PLATFORMS |

■ No Information Available

■ Partially developed in-house and partially used via partnership

■ Partially developed in-house and partially bought

■ Technological solution used via partnership with third party

■ Technological solution bought from third party

■ Technological solution largely developed and owned by the AP

FIGURE 5.27 | TOP 5 OTHER ENABLING TECHNOLOGY – OWNERSHIP
*SOURCE | AUTHOR'S OWN SOURCES*

# 6 Considerations and Implications

Disaggregated into three separate sections, Chapter 6 puts forward the considerations and implications in financial services following the adoption of enabling and innovative technologies. With respect to such technology, Chapter 6 covers the factors influencing its adoption (Section 6.1), the impact on the financial services market (section 6.2), and the consequent risks on firms (section 6.3).

## 6.1 Factors Influencing the Maltese Context

**KEY OBSERVATIONS**

- The top strength towards adopting enabling and innovative technologies was access to the ESM (34%), which was mostly significant across VFA service providers (82%).
- Local political factors (21%) were considered as the top challenge towards adopting enabling and innovative technologies, which were mostly significant across VFA service providers (45%).
- Data privacy frameworks and requirements (52%) was the top factor identified by APs that do not influence them towards the adoption of enabling and innovative technologies, which was mostly significant across financial institutions (71%).

APs were required to provide their opinion on the strengths and weaknesses towards the development and implementation of their DTSs. As presented in Figure 6.1, the top three strengths identified by APs that influence them towards the adoption of enabling and innovative technology were (i) access to the ESM (34%), (ii) the availability and access to adequate IT infrastructure (31%), and (iii) the openness and accessibility of Maltese regulation (30%). Meanwhile, the top three weaknesses identified towards the adoption of enabling and innovative technologies were (i) Maltese political factors (21%), (ii) the lack of availability and access to banking products and services (19%), and (iii) a skilled workforce (19%). From the same figure, the responses identified as neutral were mostly in relation to data privacy frameworks and requirements (52%), regulatory risk appetite (51%), and demography (51%). The full set of results relating to the strengths and weaknesses towards APs in adopting enabling and innovative technology are found in Table A4.1 within the Annex.

Figures 6.2, 6.3, and 6.4 represent the top three strengths, weaknesses and neutrality for APs towards the adoption of enabling and innovative technologies across the main authorisation sectors within the local financial services sector.
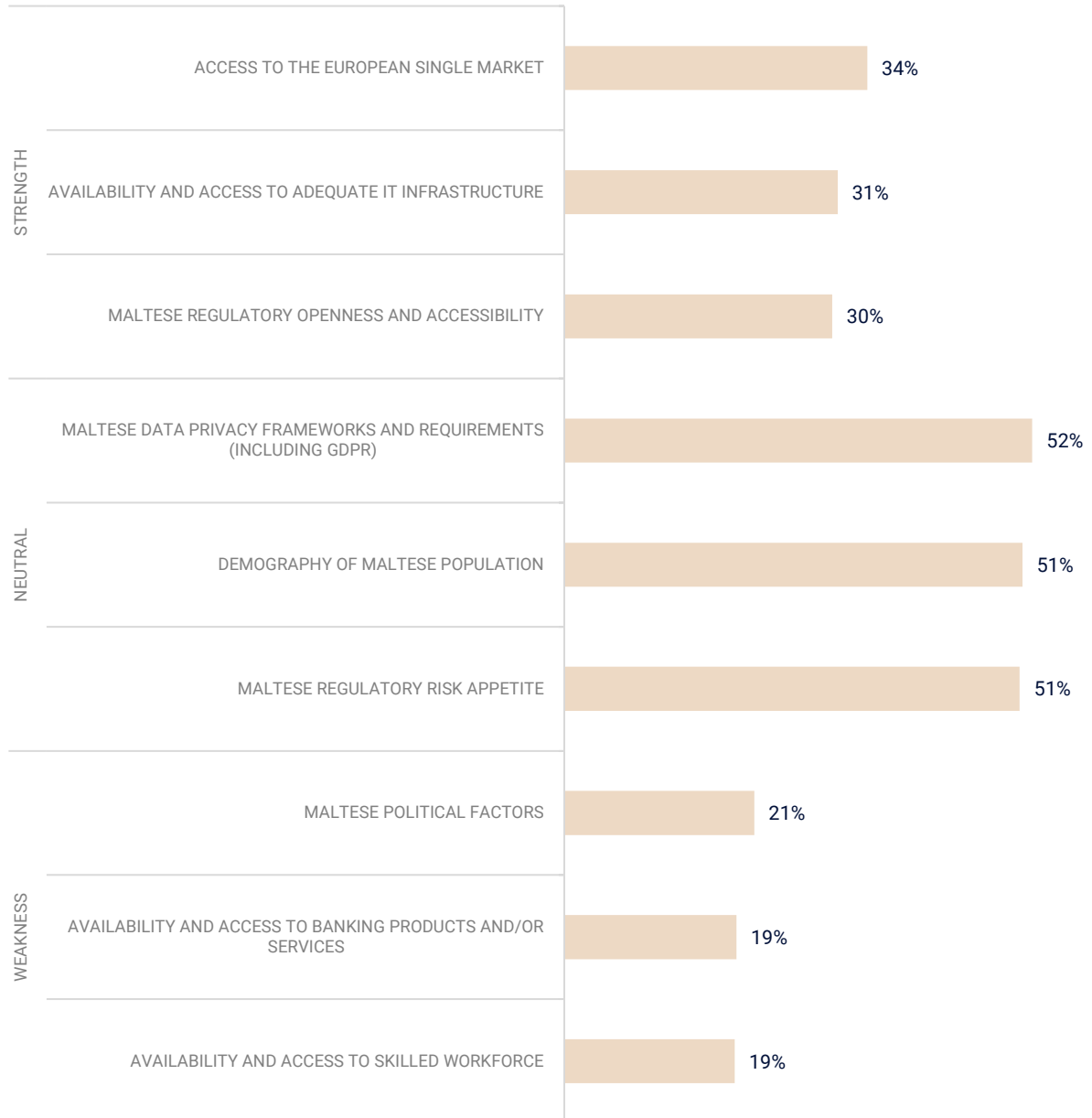
FIGURE 6.1 | TOP 3 STRENGTHS AND WEAKNESSES FOLLOWING THE ADOPTION OF ENABLING AND INNOVATIVE TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*

Figure 6.2 depicts that most VFA Service Providers consider access to the ESM (82%) as a strength towards the adoption of enabling and innovative technologies, followed by the financial (51%) and credit institution (50%) sectors. From Figure 6.2, availability and access to adequate IT infrastructure was mostly a strength towards the adoption of enabling and innovative technologies across Credit Institutions (50%), Insurance Intermediaries (42%), and Investment Service Providers (33%). From the same figure, VFA Service Providers consider Maltese regulatory openness and accessibility (64%) as the second highest strength towards the adoption of enabling and innovative technologies, followed by Insurance Intermediaries (37%), and Insurance Undertakings including PCCs (31%).
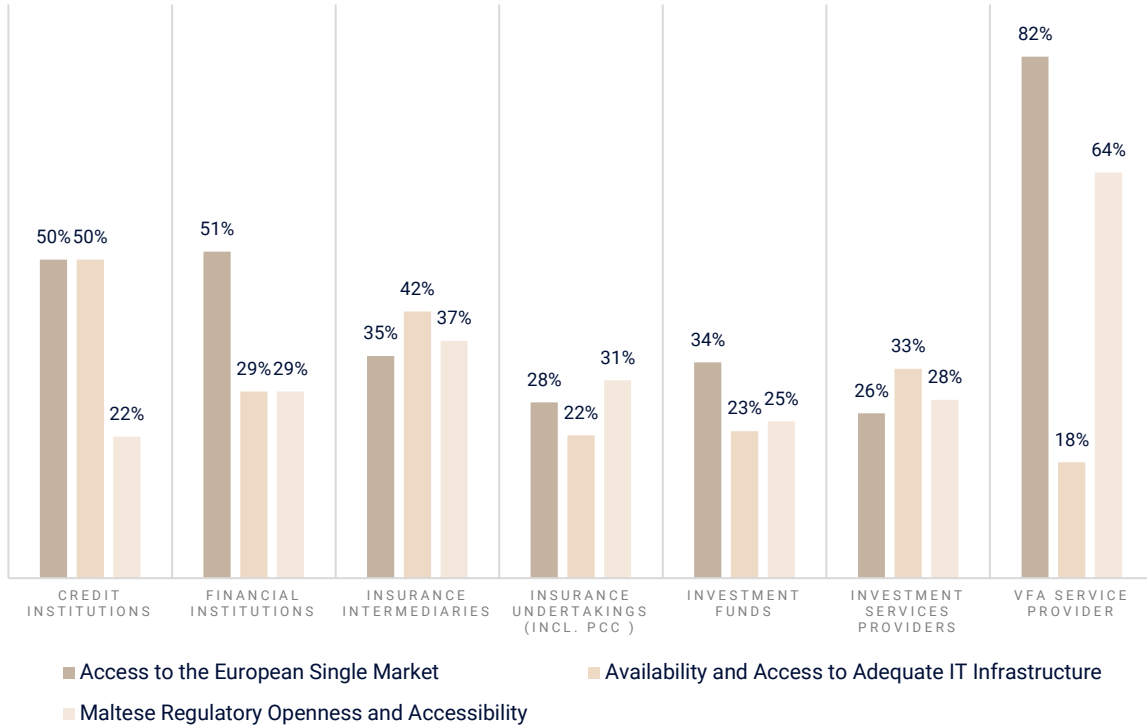
FIGURE 6.2 | TOP 3 STRENGTHS ACROSS AUTHORISATION SECTORS FOLLOWING THE ADOPTION OF ENABLING AND INNOVATIVE TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*
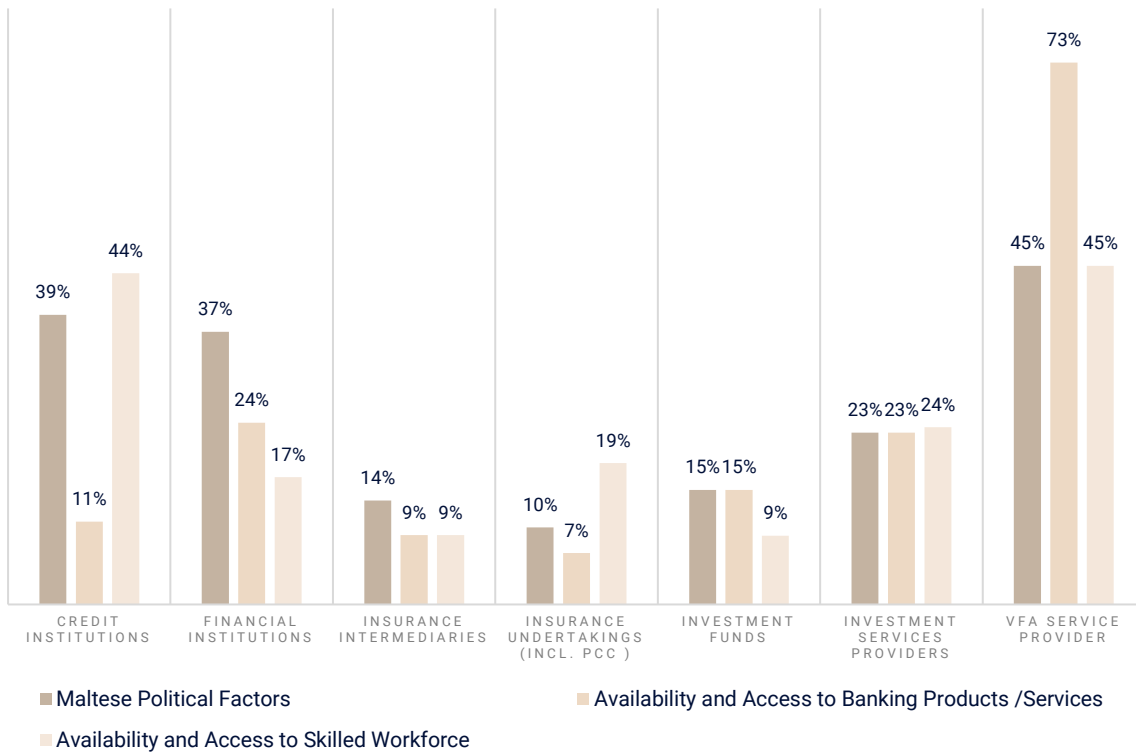


FIGURE 6.3 | TOP 3 WEAKNESSES ACROSS AUTHORISATION SECTORS FOLLOWING THE ADOPTION OF ENABLING AND INNOVATIVE TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*

Figure 6.3 depicts that most VFA Service Providers consider availability and access to banking products or services (73%) as a challenge towards the adoption of enabling and innovative technologies, followed by Financial Institutions (24%), and Investment Service Providers (23%). From Figure 6.3, political factors were mostly a challenge towards the adoption of enabling and innovative technologies across VFA Service Providers (45%), Credit Institutions (39%), and Financial Institutions (37%). From the same figure, VFA Service Providers consider the lack of availability and access to a skilled workforce (64%) as one of the top challenges towards the adoption of enabling and innovative technologies, followed by Credit Institutions (45%), and Investment Service Providers (24%).

In terms of adopting enabling and innovative technology, Figure 6.4 depicts that most VFA Service Providers are indifferent when considering risk appetite locally (73%), followed by credit institutions (67%), and financial institutions (61%). Most Financial Institutions were indifferent to Maltese data privacy frameworks and requirements (71%) towards the adoption of enabling and innovative technologies, followed by VFA Service Providers (64%), and Credit Institutions (61%). Similarly, a significant portion of Financial Institutions were indifferent to demography of Maltese population (63%) towards the adoption of enabling and innovative technologies, followed by Insurance Intermediaries (56%), and Investment Service Providers (52%). Tables A4.2, A4.3, and A4.4 within the Annex include the strengths, neutrality and weaknesses across authorisation sectors for all factors towards adopting enabling and innovative technologies, respectively.
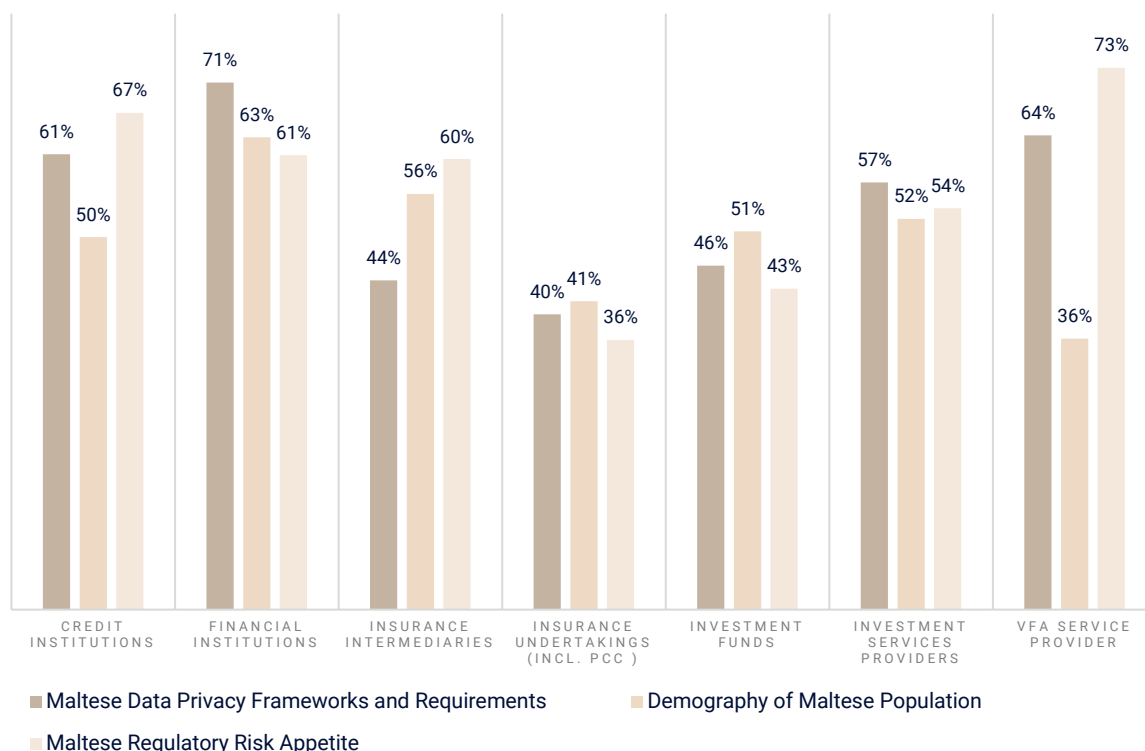


FIGURE 6.4 | TOP 3 NEUTRALITY ACROSS AUTHORISATION SECTORS FOLLOWING THE ADOPTION OF ENABLING AND INNOVATIVE TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*

## 6.2 Digital Transformation, Influence and Impact on the Financial Services Market

**KEY OBSERVATIONS**

- Based on the APs opinion, the adoption of enabling technology would extremely influence the financial services aspects of payment services and electronic money (29%), payment infrastructures (24%), and commercial banking (15%) the most. Furthermore, the financial services landscape was extremely influenced mostly following the adoption of cloud computing (26%), APIs (25%), and web and mobile applications (22%).
- Overall, the positive impact of adopting enabling technologies was identified by APs to significantly outweigh their negative impact. Based on their viewpoint, the adoption of enabling technology had a high positive impact mostly in payment services and electronic money (71%), payment infrastructures (66%), and commercial banking (58%). Additionally, the adoption of cloud computing (62%), APIs (60%), and big data and data analytics (60%) had a high positive impact on the financial services landscape.

### 6.2.1 Influence on the Financial Services Market

Based on the entire surveyed population, APs were required to provide their opinion on the degree of influence on the financial services market following the adoption of enabling and innovative technologies, as depicted in Figures 6.5 and 6.6. In accordance with the results of the EBA's risk assessment[6] of the European banking system, when considering only the extremely influential responses the aspects of financial services mostly influenced were payments services and electronic money (29%), payment infrastructures (24%), and commercial banking (15%) as set out in Figure 6.5. Considering the same level of influence, Figure 6.6 portrays that cloud computing (26%), APIs (25%), and web and mobile applications (22%) extremely influence the overall financial services landscape. The entire set of results are included in Tables A4.5 and A4.7 within the Annex, respectively.

### 6.2.2 Impact on the Financial Services Market

Building on the results presented in Figures 6.5 and 6.6 respectively, APs were required to provide their opinion on whether the impact of adopting enabling, and innovative technologies would positively or negatively impact the overall financial services market, as put forward in Figures 6.7 and 6.8. Overall, the impact on the financial services landscape following the adoption of enabling and innovative technologies was positive, with only a negligible number of APs reporting a negative impact as depicted in Figures 6.7 and 6.8. When considering only the high positive impact responses, Figure 6.7 denotes payment services and electronic money (71%), payment infrastructures (66%), and commercial banking (58%) mostly impacted following the adoption of enabling technology. Taking into account the same impact level, Figure 6.8 presents that cloud computing (62%), APIs (60%), and big data and data analytics (60%) had a high positive impact on the overall financial services market. The entire set of results are found in Table A4.6 and A4.8 within the Annex, respectively.

---

[6] EBA (2019), Risk Assessment of the European Banking System.

| | Not Influential | Slightly Influential | Somewhat Influential | Very Influential | Extremely Influential | No Information |
|---|---|---|---|---|---|---|
| PAYMENTS SERVICES AND ELECTRONIC MONEY | 6% | 9% | 28% | 29% | | 26% |
| PAYMENT INFRASTRUCTURES | 6% | 9% | 32% | 24% | | 27% |
| BANKING - COMMERCIAL BANKING | 6% | 15% | 33% | 15% | | 27% |
| CAPITAL MARKET INFRASTRUCTURES - TRADING VENUES | 7% | 5% | 15% | 22% | 12% | 38% |
| BANKING - WHOLESALE BANKING | 7% | 6% | 17% | 28% | 12% | 31% |
| INVESTMENT SERVICES | 7% | 8% | 22% | 23% | 11% | 28% |
| CAPITAL MARKET INFRASTRUCTURES - CENTRAL SECURITIES DEPOSITORIES & CLEARING AND SETTLEMENT SYSTEMS | 8% | 5% | 18% | 23% | 10% | 36% |
| RE/INSURANCE - CLAIMS HANDLING | 5% | 7% | 21% | 16% | 10% | 41% |
| INSURANCE INTERMEDIARIES | 5% | 9% | 18% | 17% | 10% | 42% |
| FUND MANAGEMENT AND SERVICING (E.G. CUSTODY/DEPOSITORIES) | 7% | 8% | 20% | 22% | 9% | 34% |
| CREDIT INTERMEDIATION | 7% | 6% | 18% | 22% | 9% | 38% |
| FUND ADMINISTRATION | 7% | 7% | 24% | 21% | 8% | 34% |
| CAPITAL MARKET INFRASTRUCTURES - OTHER | 7% | 4% | 12% | 10% | 5% | 62% |
| RE/INSURANCE - OTHER | 6% | 6% | 13% | 8% | 5% | 63% |

- Not Influential
- Slightly Influential
- Somewhat Influential
- Very Influential
- Extremely Influential
- No Information

FIGURE 6.5 | INFLUENCE ON FINANCIAL SERVICES
*SOURCE | AUTHOR'S OWN SOURCES*

| | Not Influential | Slightly Influential | Somewhat Influential | Very Influential | Extremely Influential | No Information |
|---|---|---|---|---|---|---|
| CLOUD COMPUTING | 4% | 18% | 29% | 26% | 21% | |
| API | 6% | 14% | 26% | 25% | 28% | |
| WEB AND MOBILE APPLICATIONS | 3% | 18% | 29% | 22% | 24% | |
| BIG DATA AND DATA ANALYTICS | 6% | 16% | 30% | 19% | 27% | |
| PROVISION OF A DIGITAL PLATFORM | 9% | 19% | 25% | 14% | | 32% |
| DIGITAL IDENTITY, BIOMETRICS AND SENSORS | 10% | 19% | 25% | 13% | | 30% |
| REGTECH | 8% | 17% | 21% | 12% | | 37% |
| AI & ML | 9% | 18% | 30% | 12% | | 29% |
| FINTECH-AS-A-SERVICE | 6% | 13% | 26% | 11% | | 39% |
| WFMS | 8% | 21% | 26% | 10% | | 30% |
| INTERNET OF THINGS | 10% | 11% | 17% | 14% | 10% | 38% |
| SUPTECH | 6% | 17% | 13% | 9% | | 51% |
| OPEN ARCHITECTURE | 12% | 17% | 16% | 9% | | 42% |
| PLATFORMISATION | 9% | 16% | 18% | 9% | | 46% |
| BIGTECH | 9% | 12% | 17% | 9% | | 51% |
| DLT ASSETS AND TOKENISATION OF ASSET USING DLT | 8% | 7% | 15% | 18% | 9% | 42% |
| DECENTRALISED FINANCE | 8% | 12% | 14% | 18% | 8% | 40% |
| QUANTUM COMPUTING | 10% | 6% | 17% | 13% | 8% | 46% |
| DLT | 8% | 10% | 15% | 22% | 7% | 39% |
| ALTERNATIVE CURRENCIES | 11% | 9% | 16% | 15% | 7% | 42% |
| AUTONOMOUS FINANCE | 9% | 10% | 14% | 12% | 6% | 49% |
| RPA | 6% | 10% | 17% | 16% | 6% | 45% |
| TAILORED FINANCE | 6% | 12% | 17% | 14% | 6% | 46% |
| GEOGRAPHIC INFORMATION SYSTEMS | 8% | 14% | 17% | 15% | 6% | 42% |
| EMBEDDED FINANCE | 10% | 14% | 16% | 6% | | 51% |
| METAVERSE | 12% | 12% | 15% | 9% | | 48% |
| AR & VR | 21% | 11% | 13% | 9% | | 45% |

FIGURE 6.6 | INFLUENCE OF ENABLING TECHNOLOGY AND INNOVATION
*SOURCE | AUTHOR'S OWN SOURCES*

| | High Negative Impact | Low Negative Impact | Low Positive Impact | High Positive Impact | No Information |
|---|---|---|---|---|---|
| PAYMENTS SERVICES AND ELECTRONIC MONEY | | | 22% | 71% | 5% |
| PAYMENT INFRASTRUCTURES | | | 27% | 66% | 5% |
| BANKING - COMMERCIAL BANKING | | | 32% | 58% | 7% |
| INSURANCE INTERMEDIARIES | | | 37% | 50% | 9% |
| CAPITAL MARKET INFRASTRUCTURES - TRADING VENUES | | | 36% | 50% | 11% |
| BANKING - WHOLESALE BANKING | | | 38% | 47% | 11% |
| RE/INSURANCE - OTHER | | 6% | 37% | 47% | 10% |
| RE/INSURANCE - CLAIMS HANDLING | | 5% | 38% | 47% | 10% |
| CAPITAL MARKET INFRASTRUCTURES - OTHER | | | 40% | 46% | 13% |
| CAPITAL MARKET INFRASTRUCTURES - CENTRAL SECURITIES DEPOSITORIES & CLEARING AND SETTLEMENT SYSTEMS | | | 39% | 45% | 12% |
| INVESTMENT SERVICES | | | 46% | 45% | 6% |
| FUND ADMINISTRATION | | | 43% | 44% | 9% |
| CREDIT INTERMEDIATION | | | 42% | 43% | 11% |
| FUND MANAGEMENT AND SERVICING (E.G. CUSTODY/DEPOSITORIES) | | | 47% | 40% | 9% |

■ High Negative Impact   ■ Low Negative Impact   ■ Low Positive Impact
■ High Positive Impact   ■ No Information

**FIGURE 6.7 | IMPACT ON FINANCIAL SERVICES**
*SOURCE | AUTHOR'S OWN SOURCES*

| Technology | High Negative Impact | Low Negative Impact | Low Positive Impact | High Positive Impact | No Information |
|---|---|---|---|---|---|
| CLOUD COMPUTING | | | 30% | 62% | 6% |
| API | | | 32% | 60% | 7% |
| BIG DATA AND DATA ANALYTICS | | | 34% | 60% | 6% |
| WEB AND MOBILE APPLICATIONS | | | 35% | 58% | 6% |
| AI & ML | | | 39% | 51% | 8% |
| WFMS | | | 40% | 50% | 9% |
| DIGITAL IDENTITY, BIOMETRICS AND SENSORS | | | 39% | 48% | 10% |
| PROVISION OF A DIGITAL PLATFORM | | | 42% | 47% | 9% |
| DLT | | | 45% | 45% | 7% |
| REGTECH | | | 44% | 43% | 9% |
| RPA | | | 41% | 41% | 14% |
| FINTECH-AS-A-SERVICE | | | 46% | 41% | 10% |
| SUPTECH | | | 45% | 39% | 11% |
| PLATFORMISATION | | | 50% | 39% | 8% |
| INTERNET OF THINGS | | | 46% | 38% | 13% |
| BIGTECH | | 7% | 39% | 38% | 14% |
| GEOGRAPHIC INFORMATION SYSTEMS | | | 50% | 35% | 12% |
| QUANTUM COMPUTING | | | 47% | 34% | 16% |
| DLT ASSETS AND TOKENISATION OF ASSET USING DLT | | 15% | 39% | 33% | 10% |
| ALTERNATIVE CURRENCIES | | 16% | 34% | 32% | 13% |
| AUTONOMOUS FINANCE | | | 48% | 32% | 17% |
| OPEN ARCHITECTURE | | | 51% | 31% | 14% |
| EMBEDDED FINANCE | | | 54% | 30% | 12% |
| DECENTRALISED FINANCE | | | 51% | 30% | 13% |
| TAILORED FINANCE | | | 58% | 25% | 14% |
| AR & VR | | 12% | 47% | 24% | 17% |
| METAVERSE | | 13% | 51% | 19% | 17% |

■ High Negative Impact     ■ Low Negative Impact     ■ Low Positive Impact

■ High Positive Impact     ■ No Information

FIGURE 6.8 | IMPACT OF ENABLING TECHNOLOGY AND INNOVATION
*SOURCE | AUTHOR'S OWN SOURCES*

## 6.3 Perceived Risks of Enabling Technologies and Innovations

**KEY OBSERVATIONS**

–   Cyber risk was identified as the highest level of risk, which APs believe is mostly present in cloud computing, web and mobile applications, and APIs. This was followed by operational risk and reputational risk.
–   With regards to the level of risks, the ranking for cloud computing, web and mobile applications, and APIs were the same for cyber, operational, and reputational risks.
–   In terms of the top 3 risks, a significant number of APs believe that the increase in risk is low.

### 6.3.1 The Degree of Risks Across the Adoption of Enabling Technologies

Although FinTech adoption comes with its own benefits as described and expounded upon in Chapter 6, it also has the potential to increase certain risks to customers, firms, the entire financial system, and the wider economy. To assess any potential financial stability implications, APs were required to provide their opinion on the degree of various risks associated with the adoption of every enabling and innovative technology. The risks considered in the FAS are cyber, operational, market, credit, leverage, liquidity and reputational risks. In the context of the FAS, reputational risk was seen as an indirect risk arising mainly due to reliance on third-party service providers. The results are depicted in Figure 6.9 and Tables A4.9 to A4.15 within the Annex.

Considering only medium increase in risk and high increase in risk responses, Figure 6.9 presents the magnitude and different type of risks across enabling technologies as provided by APs. From Figure 6.9, the viewpoint of APs was that the top three risks were cyber risk, operational risk, and reputational risk. From the same figure, cloud computing (30%), web and mobile applications (28%), and APIs (21%) were the top three enabling technologies with the highest level of cyber risk, respectively. Similarly, for operational risk, the top three enabling technologies with the highest level of risk were cloud computing (19%), web and mobile applications (19%), and APIs (12%). The same ranking for cloud computing, web and mobile applications, and APIs applies for reputational risk. Therefore, the ranking of cloud computing, web and mobile applications, and APIs influenced by the top three risks remains unchanged implying that cloud computing remains the technology mostly subject to risk, followed by web and mobile applications, and APIs.

In its attempt to assess the financial stability implications of FinTech, the FSB[7] had also identified cyber risk and operational risk as priority areas to be closely monitored as more enabling technologies continue to emerge. According to the AP's opinion, cyber, operational, and reputational risks were identified as those risks which most likely will increase due to the adoption of enabling and innovative technologies. A more in-depth assessment for each of these risks is set out below.

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[7] FSB (2017), Financial Stability Implications from FinTech – Supervisory and Regulatory Issues that Merit Authorities' Attention.

FIGURE 6.9 | RISK EXPOSURE ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*

### 6.3.2 Cyber Risk

Based on the opinion of APs, 28 per cent suggested a low increase in cyber risk following the adoption of cloud computing as depicted in Figure 6.19. From the same figure, whilst 19 per cent of APs highlighted a moderate increase in cyber risk following the adoption of cloud computing, 11% of APs adopted a more cautious approach with the view that cloud computing exposed them to a higher level of cyber risk. From Figure 6.10 and across the top five technologies highlighted as risky by APs, the percentage of responses decreased gradually from one risk level to another, with low increase in risk being the most popular. This indicates that although cyber risk was perceived as the highest type of risk, APs believed that it was perceived as a risk which was not increasing significantly. Table A4.9 within the Annex presents the entire set of results reflecting the different level of cyber risks across enabling and innovative technologies.
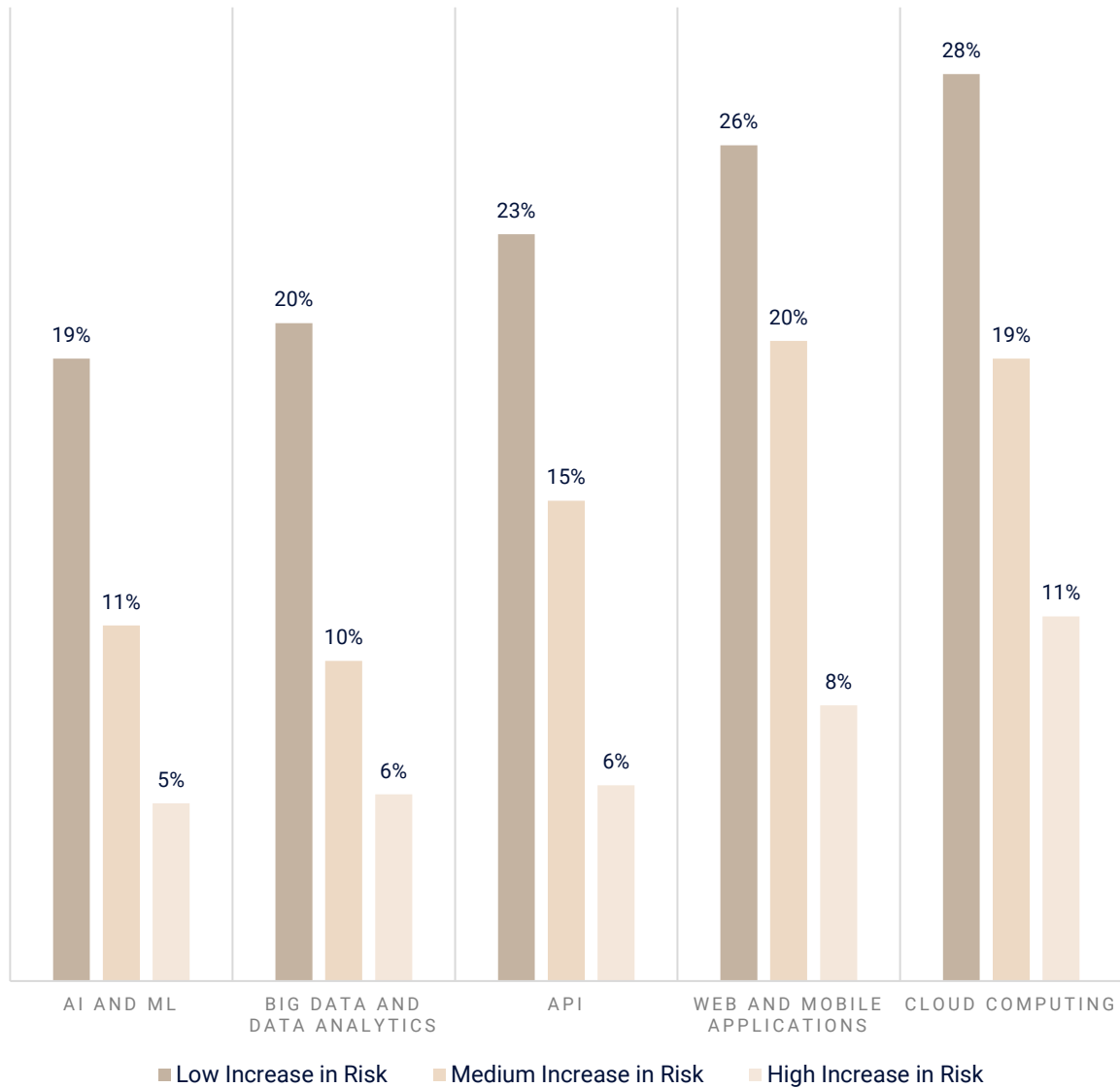


FIGURE 6.10 | THE DEGREE OF CYBER RISK ACROSS ENABLING TECHNOLOGIES
*SOURCE | AUTHOR'S OWN SOURCES*

### 6.3.3  Operational Risk

Compared to cyber risk, fewer APs believe that there is an overall high increase in operational risk across the top five technologies that were highlighted as risky by APs as presented in Figure 6.11. From Figure 6.11 and Table A4.10 within the Annex, according to APs the highest increases in operational risk were observed in cloud computing and alternative currencies, amounting to six per cent. Also, from the same figures, the most significant low increase in operational risk across enabling and innovative technologies were observed in web and mobile applications, amounting to 27 per cent. Similar, to cyber risk, the percentage of responses decreased from one risk level to another, with low increase in risk being the most selected option across the top five enabling technologies perceived as risky.
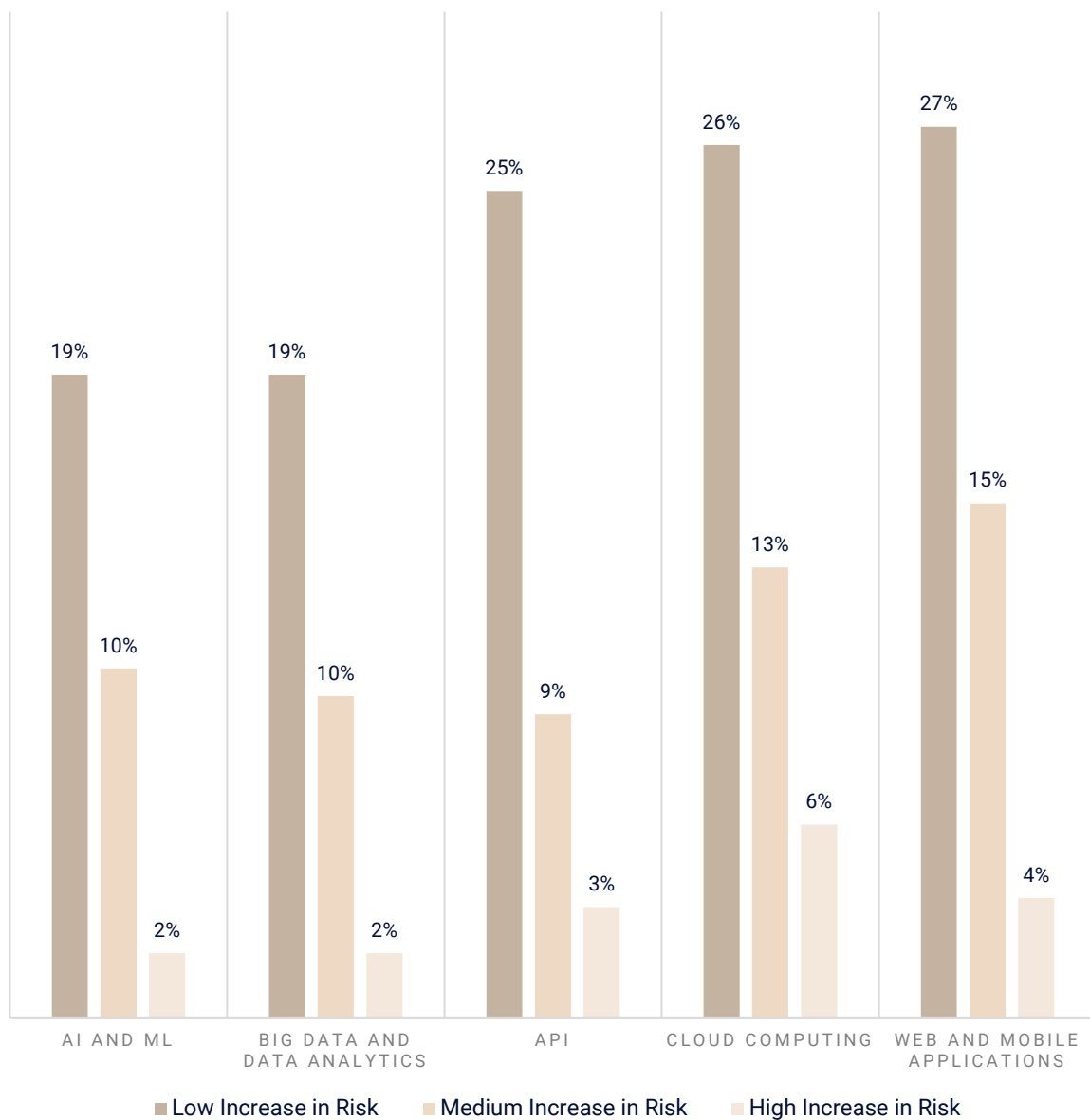


Figure 6.11 | The Degree of Operational Risk Across Enabling Technologies
Source | Author's Own Sources

### 6.3.4    Reputational Risk

Compared to cyber and operational risks as presented in Figures 6.10 and 6.11 respectively, the degree of reputational risk across the top five enabling technologies deemed the riskiest by APs was overall lower. Within the context of reputational risk and according to the APs viewpoint, web and mobile applications (26%) were identified mostly to increase risk at a low magnitude, followed by cloud computing (22%) as depicted in Figure 6.12. From the same figure, web and mobile applications (4%) and cloud computing (4%) were identified by APs to highly increase risk. However, APs pinpoint that the highest increase in reputational risk were in alternative currencies and DLT assets and tokenisation, amounting to eight per cent.

Similar to cyber and operational risks, reputational risk was mainly significant across cloud computing, web and mobile applications, and APIs, with low increase in risk being the most selected option across the top five perceived risky technologies. The remaining set of results highlighting the opinions of APs in terms of the types, and level of risks across enabling and innovative technologies are found in Tables A4.9 to A4.15 within the Annex.
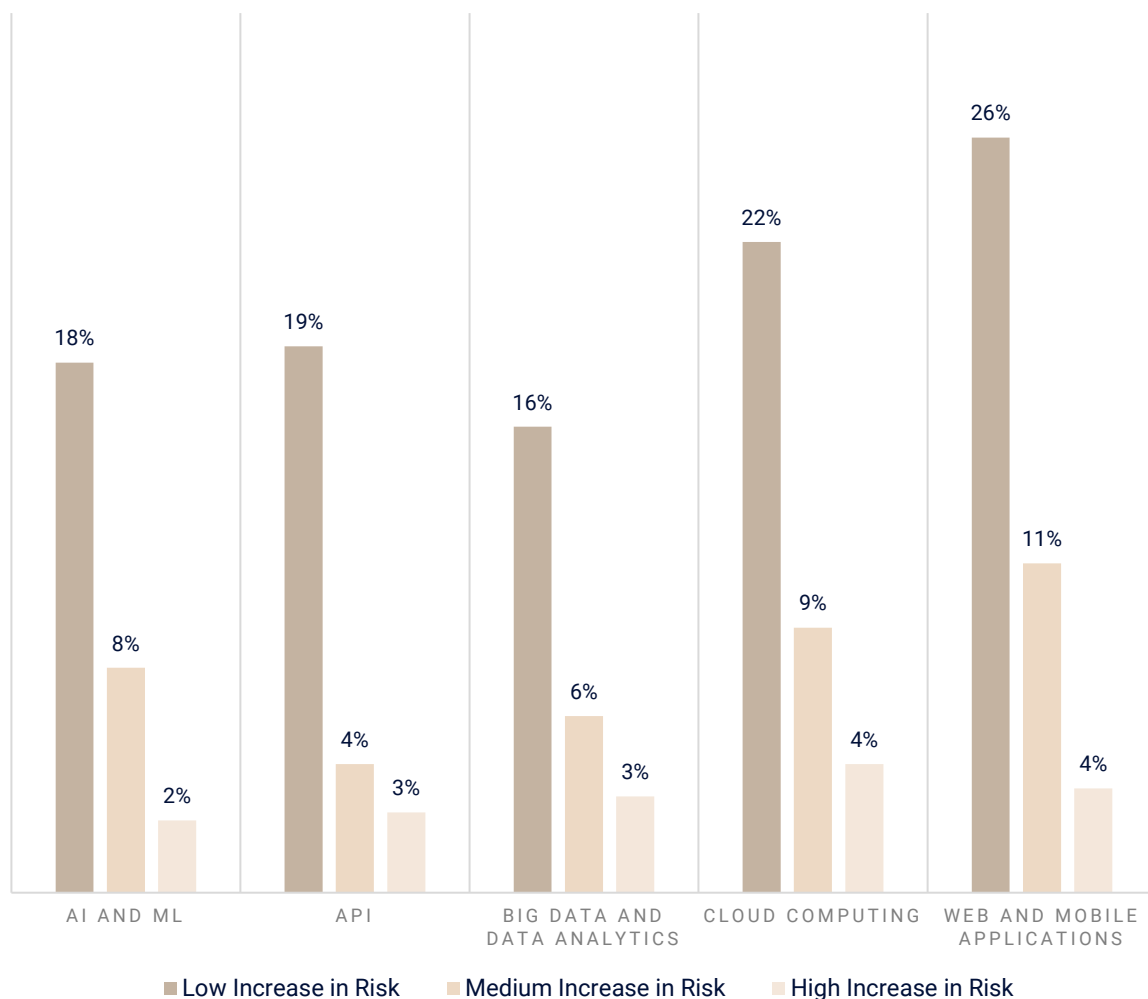


Figure 6.12 | The Degree of Reputational Risk Across Enabling Technologies
Source | Author's Own Sources

# 7 References

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# 8 Annex

**TABLE A1.1 | AUTHORISATIONS FALLING WITH SCOPE OF STUDY**

| | |
|---|---|
| **Credit Institutions** | Credit Institutions |
| **Financial Institutions** | Financial Institutions licenced to issue electronic money under the 3rd Schedule to the Financial Institutions Act (Electronic Money Institutions) |
| | Financial Institutions licensed in terms of the Financial Institutions Act |
| | Financial Institutions licensed to undertake payment services under the 2nd Schedule to the Financial Institutions Act (Payment Institutions) |
| **Insurance Intermediaries** | Intermediaries - Insurance Brokers List |
| | Intermediaries - Insurance Managers List |
| | Intermediaries - Protected Cell Companies |
| **Insurance Undertakings (incl. PCC)** | Protected Cell Companies Writing Insurance Business |
| | Insurance Undertakings |
| | Reinsurance Undertakings |
| **Investment Service** | AIF Manager |
| | De Minimis AIF Manager |
| | Depositaries |
| | Depositary Lite |
| | Investment Firms |
| | Recognised Fund Administrators |
| | Recognised Incorporated Cell Company |
| | UCITS Managers |
| **Investment Funds** | Self-Managed Retail - Maltese UCITS Schemes |
| | Self-Managed Alternative Investment Funds |
| | Self-Managed Professional Investor Funds |
| **Capital Markets** | Central Securities Depositories |
| | Regulated Markets |
| **VFA Framework** | VFA Service Providers |

*Source | Author's Own Sources*

## TABLE A2.1 | MAIN SOURCES OF FINANCING

| | No Information Available | Not Utilised | Utilised \| Low Importance | Utilised \| Important | Utilised \| Very Important | Total |
|---|---|---|---|---|---|---|
| **Own funding** | 6% | 5% | 8% | 25% | 57% | 100% |
| **Private Equity** | 12% | 81% | 2% | 4% | 2% | 100% |
| **Capital Markets - Debt** | 12% | 84% | 2% | 3% | 0% | 100% |
| **Bank Loans** | 12% | 84% | 2% | 2% | 1% | 100% |
| **Capital Markets - Equity** | 12% | 84% | 0% | 3% | 1% | 100% |
| **State Aid** | 12% | 86% | 2% | 1% | 0% | 100% |
| **Venture Capital** | 12% | 86% | 1% | 1% | 0% | 100% |
| **Business Angels** | 13% | 87% | 0% | 1% | 0% | 100% |
| **Crowdfunding** | 11% | 89% | 0% | 0% | 1% | 100% |

*Source | Author's Own Sources*

**TABLE A2.2 | MAIN SOURCES OF COOPERATION**

| | No information available | Most used/preferred approach | Approach frequently used | Approach used occasionally | Approach used very seldom | Approach not used | Total |
|---|---|---|---|---|---|---|---|
| **No cooperation** | 23% | 21% | 9% | 2% | 3% | 41% | 100% |
| **Invest in (Fin)Tech firms** | 17% | 1% | 2% | 1% | 3% | 77% | 100% |
| **Joint venture** | 17% | 1% | 1% | 2% | 2% | 78% | 100% |
| **Accelerator/innovation labs** | 16% | 0% | 2% | 3% | 1% | 79% | 100% |
| **Acquisitions** | 17% | 1% | 0% | 3% | 3% | 77% | 100% |
| **Partnerships** | 17% | 4% | 4% | 9% | 2% | 65% | 100% |
| **Consortia** | 18% | 1% | 1% | 1% | 2% | 79% | 100% |
| **Consultants** | 9% | 18% | 19% | 19% | 6% | 29% | 100% |
| **Third-Party Service Providers** | 13% | 35% | 23% | 10% | 2% | 16% | 100% |

*Source | Author's Own Sources*

**TABLE A3.1 | SECTORAL ADOPTION OF ENABLING TECHNOLOGY IN 2021**

| | DLT | AI and ML | Big Data and Data Analytics | DBS | API | Cloud Computing | Quantum Computing | AR and VR | RPA | WfMS | Web and Mobile applications | Provision of a Digital Platform | GIS | Other | None of the above | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Credit Institutions** | 1% | 10% | 11% | 11% | 12% | 11% | 0% | 1% | 7% | 13% | 13% | 9% | 3% | 0% | 0% | 100% |
| **VFA Service Providers** | 9% | 5% | 9% | 7% | 16% | 14% | 0% | 0% | 0% | 9% | 16% | 12% | 4% | 0% | 0% | 100% |
| **Insurance Undertakings (incl. PCC)** | 1% | 9% | 12% | 4% | 16% | 16% | 0% | 0% | 6% | 9% | 14% | 10% | 1% | 1% | 1% | 100% |
| **Financial Institutions** | 1% | 4% | 8% | 9% | 20% | 18% | 0% | 0% | 3% | 10% | 14% | 8% | 4% | 0% | 1% | 100% |
| **Investment Funds** | 6% | 6% | 12% | 0% | 9% | 18% | 0% | 0% | 0% | 9% | 18% | 3% | 3% | 0% | 15% | 100% |
| **Investment Services Providers** | 1% | 4% | 7% | 6% | 14% | 22% | 0% | 1% | 4% | 11% | 14% | 10% | 2% | 2% | 2% | 100% |
| **Insurance Intermediaries** | 1% | 0% | 1% | 1% | 13% | 27% | 0% | 1% | 8% | 15% | 16% | 13% | 1% | 1% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.2 | DLT – APPLICABILITY**

|  | Yes | No |
|---|---|---|
| Issuance of Crypto Assets as Financial Instrument | 13% | 87% |
| Issuance of Crypto Assets as Utility Tokens | 13% | 87% |
| Issuance of Any Other Crypto Assets | 13% | 87% |
| Provision or Use of DLT Based Solutions for Smart Contracts | 13% | 87% |
| Provisions or Use of DLT Based Solutions for Communication Purposes | 13% | 87% |
| Provision or Use of DLT Based Solutions for The Operation of a Payment Infrastructure | 13% | 87% |
| Non-Custodial Wallet Provider | 20% | 80% |
| Provisions or Use of DLT Based Solutions for Digital Identity or Access Management Purposes | 20% | 80% |
| Provision or Use of DLT Based Solutions for Information Recording, Data Storage or General Documentation Purposes | 20% | 80% |
| Provision or Use of DeFi Applications | 27% | 73% |
| Issuance of Crypto Assets as means of Payments | 33% | 67% |
| Provision or Use of DLT Based Solutions for Clearing and Settlement | 40% | 60% |
| Provisions or Use of DLT Based Solutions for Payment Purposes | 47% | 53% |

*Source | Author's Own Sources*

## TABLE A3.3 | DLT - STAGE OF ADOPTION

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Issuance of Crypto Assets as means of Payments** | 20% | 20% | 20% | 20% | 20% | 0% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Financial Instrument** | 33% | 33% | 0% | 0% | 0% | 33% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Utility Tokens** | 0% | 0% | 0% | 33% | 33% | 33% | 0% | 0% | 100% |
| **Issuance of Any Other Crypto Assets** | 33% | 0% | 0% | 0% | 0% | 33% | 33% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Payment Purposes** | 14% | 14% | 14% | 0% | 14% | 0% | 14% | 29% | 100% |
| **Non-Custodial Wallet Provider** | 0% | 25% | 0% | 0% | 50% | 25% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Clearing and Settlement Purposes** | 17% | 17% | 0% | 0% | 50% | 0% | 0% | 17% | 100% |
| **Provision or Use of DLT Based Solutions for Smart Contracts** | 0% | 0% | 0% | 0% | 0% | 60% | 20% | 20% | 100% |
| **Provision or Use of DeFi Applications** | 0% | 17% | 0% | 0% | 0% | 33% | 50% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Communication Purposes** | 0% | 0% | 0% | 0% | 33% | 33% | 33% | 0% | 100% |

**TABLE A3.3 | DLT - STAGE OF ADOPTION**

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Provisions or Use of DLT Based Solutions for Digital Identity or Access Management Purposes** | 0% | 0% | 0% | 25% | 25% | 25% | 25% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Information Recording, Data Storage or General Documentation Purposes** | 0% | 0% | 0% | 50% | 25% | 25% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for The Operation of a Payment Infrastructure** | 0% | 0% | 33% | 0% | 33% | 33% | 0% | 0% | 100% |

*Source | Author's Own Sources*

## TABLE A3.4 | DLT - TIME OF DEPLOYMENT

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Issuance of Crypto Assets as means of Payments** | 20% | 20% | 60% | 0% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Financial Instrument** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Utility Tokens** | 33% | 33% | 33% | 0% | 0% | 0% | 100% |
| **Issuance of Any Other Crypto Assets** | 33% | 33% | 0% | 33% | 0% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Payment Purposes** | 14% | 43% | 43% | 0% | 0% | 0% | 100% |
| **Non-Custodial Wallet Provider** | 50% | 50% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Clearing and Settlement Purposes** | 33% | 50% | 17% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Smart Contracts** | 60% | 0% | 40% | 0% | 0% | 0% | 100% |
| **Provision or Use of DeFi Applications** | 33% | 17% | 50% | 0% | 0% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Communication Purposes** | 33% | 67% | 0% | 0% | 0% | 0% | 100% |

**TABLE A3.4 | DLT - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Provisions or Use of DLT Based Solutions for Digital Identity or Access Management Purposes** | 25% | 50% | 25% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Information Recording or Data storage or General Documentation Purposes** | 50% | 50% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for The Operation of a Payment Infrastructure** | 33% | 33% | 33% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

## TABLE A3.5 | DLT - OWNERSHIP

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Issuance of Crypto Assets as means of Payments** | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Financial Instrument** | 50% | 50% | 0% | 0% | 0% | 0% | 100% |
| **Issuance of Crypto Assets as Utility Tokens** | 33% | 67% | 0% | 0% | 0% | 0% | 100% |
| **Issuance of Any Other Crypto Assets** | 33% | 67% | 0% | 0% | 0% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Payment Purposes** | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| **Non-Custodial Wallet Provider** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Clearing and Settlement Purposes** | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Smart Contracts** | 75% | 25% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DeFi Applications** | 67% | 33% | 0% | 0% | 0% | 0% | 100% |
| **Provisions or Use of DLT Based Solutions for Communication Purposes** | 50% | 50% | 0% | 0% | 0% | 0% | 100% |

## TABLE A3.5 | DLT - OWNERSHIP

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Provisions or Use of DLT Based Solutions for Digital Identity or Access Management Purposes** | 33% | 67% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions for Information Recording or Data storage or General Documentation Purposes** | 67% | 33% | 0% | 0% | 0% | 0% | 100% |
| **Provision or Use of DLT Based Solutions For The Operation of a Payment Infrastructure** | 33% | 67% | 0% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

Source | Author's Own Sources

**TABLE A3.6 | AI AND ML - APPLICABILITY**

| | Yes | No |
|---|---|---|
| **Robo-/Automated Advice** | 7% | 93% |
| **Use of AI for Monitoring Conduct Risk** | 7% | 93% |
| **Use of AI for Creditworthiness Assessment/Credit Scoring** | 9% | 91% |
| **Use of AI for Suitability and Appropriateness Assessment** | 9% | 91% |
| **Algorithmic Trading** | 13% | 87% |
| **Financial, Risk and Regulatory Reporting** | 20% | 80% |
| **Use of AI for Real-Time Monitoring of Payments, Including Verifying the Identification of Payers and Payees** | 20% | 80% |
| **Use of AI for Risk Modelling** | 20% | 80% |
| **Marketing** | 24% | 76% |
| **Text Mining/NLP** | 24% | 76% |
| **KYC Processes/Client Authentication and Identification** | 29% | 71% |
| **Image processing/Computer Vision** | 29% | 71% |
| **Fraud Prevention and Detection** | 38% | 62% |
| **AI for Operational Efficiency** | 38% | 62% |
| **AML Prevention and Detection** | 42% | 58% |
| **Cybercrime Prevention and Detection** | 44% | 56% |
| **Chatbots and Virtual Assistants** | 49% | 51% |

*Source | Author's Own Sources*

## TABLE A3.6 | AI AND ML – STAGE OF ADOPTION

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Creditworthiness Assessment and Credit Scoring** | 64% | 9% | 0% | 0% | 0% | 9% | 18% | 0% | 100% |
| **Suitability and Appropriateness Assessment** | 64% | 18% | 0% | 0% | 0% | 0% | 9% | 9% | 100% |
| **Algorithmic Trading** | 45% | 9% | 0% | 0% | 27% | 9% | 0% | 9% | 100% |
| **Robo and Automated Advice** | 60% | 10% | 10% | 0% | 20% | 0% | 0% | 0% | 100% |
| **Marketing** | 27% | 33% | 7% | 0% | 0% | 20% | 13% | 0% | 100% |
| **KYC, Client Authentication, and Identification** | 26% | 5% | 5% | 0% | 5% | 11% | 16% | 32% | 100% |
| **Chatbots and Virtual Assistants** | 31% | 23% | 0% | 4% | 15% | 12% | 8% | 8% | 100% |
| **AML Prevention and Detection** | 22% | 9% | 0% | 9% | 9% | 9% | 17% | 26% | 100% |
| **Fraud Prevention and Detection** | 22% | 17% | 4% | 0% | 0% | 13% | 17% | 26% | 100% |
| **Cybercrime Prevention and Detection** | 17% | 0% | 4% | 4% | 4% | 17% | 26% | 26% | 100% |

**TABLE A3.6 | AI AND ML – STAGE OF ADOPTION**

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Financial, Risk and Regulatory Reporting** | 31% | 8% | 8% | 0% | 0% | 15% | 23% | 15% | 100% |
| **AI for Operational Efficiency** | 16% | 26% | 11% | 5% | 0% | 11% | 26% | 5% | 100% |
| **Real-Time Payments Monitoring and Identity Verification** | 38% | 13% | 6% | 0% | 0% | 13% | 6% | 25% | 100% |
| **Monitoring Conduct Risk** | 63% | 25% | 0% | 0% | 0% | 13% | 0% | 0% | 100% |
| **Risk Modelling** | 31% | 15% | 15% | 0% | 8% | 8% | 15% | 8% | 100% |
| **Text Mining and Natural Language Processing** | 31% | 25% | 6% | 6% | 0% | 19% | 6% | 6% | 100% |
| **Image processing and Computer Vision** | 47% | 0% | 5% | 0% | 0% | 21% | 5% | 21% | 100% |

*Source | Author's Own Sources*

## TABLE A3.8 | AI AND ML - TIME OF DEPLOYMENT

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Creditworthiness Assessment and Credit Scoring** | 73% | 27% | 0% | 0% | 0% | 0% | 100% |
| **Suitability and Appropriateness Assessment** | 64% | 18% | 0% | 0% | 18% | 0% | 100% |
| **Algorithmic Trading** | 50% | 30% | 10% | 10% | 0% | 0% | 100% |
| **Robo and Automated Advice** | 56% | 22% | 0% | 22% | 0% | 0% | 100% |
| **Marketing** | 40% | 33% | 0% | 13% | 13% | 0% | 100% |
| **KYC, Client Authentication, and Identification** | 26% | 58% | 11% | 5% | 0% | 0% | 100% |
| **Chatbots and Virtual Assistants** | 32% | 44% | 4% | 4% | 16% | 0% | 100% |
| **AML Prevention and Detection** | 22% | 52% | 13% | 13% | 0% | 0% | 100% |
| **Fraud Prevention and Detection** | 23% | 55% | 9% | 0% | 14% | 0% | 100% |
| **Cybercrime Prevention and Detection** | 13% | 70% | 9% | 9% | 0% | 0% | 100% |
| **Financial, Risk and Regulatory Reporting** | 33% | 50% | 8% | 8% | 0% | 0% | 100% |
| **AI for Operational Efficiency** | 42% | 37% | 16% | 5% | 0% | 0% | 100% |

**TABLE A3.8 | AI AND ML - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Real-Time Payments Monitoring and Identity Verification** | 33% | 40% | 13% | 13% | 0% | 0% | 100% |
| **Monitoring Conduct Risk** | 71% | 14% | 0% | 14% | 0% | 0% | 100% |
| **Risk Modelling** | 42% | 42% | 8% | 8% | 0% | 0% | 100% |
| **Text Mining and Natural Language Processing** | 53% | 33% | 13% | 0% | 0% | 0% | 100% |
| **Image processing and Computer Vision** | 41% | 41% | 12% | 6% | 0% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.9 | AI AND ML - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Creditworthiness Assessment and Credit Scoring** | 64% | 27% | 0% | 9% | 0% | 0% | 100% |
| **Suitability and Appropriateness Assessment** | 82% | 9% | 0% | 9% | 0% | 0% | 100% |
| **Algorithmic Trading** | 50% | 20% | 0% | 20% | 0% | 10% | 100% |
| **Robo and Automated Advice** | 56% | 11% | 11% | 11% | 11% | 0% | 100% |
| **Marketing** | 40% | 20% | 27% | 13% | 0% | 0% | 100% |
| **KYC, Client Authentication, and Identification** | 26% | 11% | 11% | 47% | 0% | 5% | 100% |
| **Chatbots and Virtual Assistants** | 24% | 12% | 40% | 16% | 4% | 4% | 100% |
| **AML Prevention and Detection** | 22% | 9% | 26% | 39% | 4% | 0% | 100% |
| **Fraud Prevention and Detection** | 23% | 0% | 36% | 36% | 0% | 5% | 100% |
| **Cybercrime Prevention and Detection** | 13% | 4% | 35% | 43% | 0% | 4% | 100% |
| **Financial, Risk and Regulatory Reporting** | 33% | 8% | 33% | 25% | 0% | 0% | 100% |

**TABLE A3.9 | AI AND ML - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **AI for Operational Efficiency** | 37% | 21% | 16% | 5% | 16% | 5% | 100% |
| **Real-Time Payments Monitoring and Identity Verification** | 33% | 13% | 20% | 27% | 0% | 7% | 100% |
| **Monitoring Conduct Risk** | 71% | 14% | 0% | 0% | 0% | 14% | 100% |
| **Risk Modelling** | 33% | 25% | 17% | 8% | 0% | 17% | 100% |
| **Text Mining and Natural Language Processing** | 60% | 20% | 13% | 0% | 0% | 7% | 100% |
| **Image processing and Computer Vision** | 47% | 6% | 12% | 18% | 6% | 12% | 100% |

*Source | Author's Own Sources*

**Table A3.10 | API - Applicability**

| | Yes | No |
|---|---|---|
| **Enabling Clients to Use Services Provided by Other APs** | 29% | 71% |
| **Provision of an Interface and Connecting Customers and Service Providers** | 42% | 58% |
| **Facilitate Use of Other Services Provided by the AP** | 45% | 55% |
| **Account Information Related Services** | 52% | 48% |
| **Payment Related Services** | 61% | 39% |
| **Regulatory Compliance, Fraud and Risk Reduction** | 66% | 34% |

*Source | Author's Own Sources*

**TABLE A3.11 | API - STAGE OF ADOPTION**

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Payment Related Services** | 4% | 11% | 11% | 3% | 9% | 9% | 23% | 30% | 100% |
| **Account Information Related Services** | 3% | 11% | 5% | 0% | 20% | 11% | 26% | 25% | 100% |
| **Facilitate the Use of Other Services Provided by The AP to its Clients** | 13% | 8% | 3% | 5% | 10% | 8% | 25% | 28% | 100% |
| **Enabling AP's Clients to Use Services Provided by Other APs** | 21% | 12% | 5% | 2% | 10% | 7% | 17% | 26% | 100% |
| **APIs to Other APs** | 16% | 17% | 3% | 3% | 9% | 7% | 19% | 26% | 100% |
| **Regulatory Compliance, Fraud and Risk Reduction** | 8% | 12% | 6% | 5% | 4% | 13% | 19% | 33% | 100% |

*Source | Author's Own Sources*

**Table A3.12 | API - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Payment Related Services** | 12% | 66% | 9% | 12% | 0% | 0% | 100% |
| **Account Information Related Services** | 6% | 79% | 3% | 10% | 2% | 0% | 100% |
| **Facilitate the Use of Other Services Provided by The AP to its Clients** | 17% | 66% | 10% | 5% | 2% | 0% | 100% |
| **Enabling AP's Clients to Use Services Provided by Other APs** | 30% | 55% | 5% | 5% | 5% | 0% | 100% |
| **APIs to Other APs** | 21% | 58% | 7% | 11% | 4% | 0% | 100% |
| **Regulatory Compliance, Fraud and Risk Reduction** | 16% | 66% | 13% | 2% | 2% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.13 | API - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Payment Related Services** | 10% | 37% | 15% | 19% | 11% | 8% | 100% |
| **Account Information Related Services** | 6% | 45% | 18% | 14% | 6% | 11% | 100% |
| **Facilitate the Use of Other Services Provided by The AP to its Clients** | 16% | 44% | 11% | 15% | 5% | 8% | 100% |
| **Enabling AP's Clients to Use Services Provided by Other APs** | 27% | 37% | 5% | 17% | 7% | 7% | 100% |
| **APIs to Other APs** | 21% | 28% | 17% | 21% | 5% | 9% | 100% |
| **Regulatory Compliance, Fraud and Risk Reduction** | 13% | 12% | 33% | 18% | 14% | 10% | 100% |

*Source | Author's Own Sources*

**TABLE A3.14 | DBS - APPLICABILITY**

| | Yes | No |
|---|---|---|
| **Biometrics - Eyes** | 0% | 100% |
| **Biometrics - Hand Geometry (Gestures)** | 2% | 98% |
| **Biometrics - Gait** | 2% | 98% |
| **Biometrics - Heartbeat** | 2% | 98% |
| **Biometrics - Odour** | 2% | 98% |
| **Biometrics - DNA** | 2% | 98% |
| **Biometrics - Vascular (Vein)** | 2% | 98% |
| **Sensors - Pressure: Ownership of Technological Solution** | 2% | 98% |
| **Sensors - Level** | 2% | 98% |
| **Sensors - Gyroscope** | 2% | 98% |
| **Sensors - Gas** | 2% | 98% |
| **Sensors - Optical** | 2% | 98% |
| **Biometrics - Keystrokes (Typing)** | 4% | 96% |
| **Sensors - Proximity: Ownership of Technological Solution** | 4% | 96% |
| **Sensors - Accelerometers** | 4% | 96% |
| **Sensors - Infrared** | 4% | 96% |
| **Biometrics - Voice/Speech** | 9% | 91% |
| **Sensors - Humidity** | 11% | 89% |
| **Sensors - Temperature** | 13% | 87% |
| **Digital Identity - Self-sovereign Identity** | 26% | 74% |
| **Biometrics - Fingerprint/Palmprint** | 54% | 46% |
| **Biometrics - Face** | 67% | 33% |
| **Digital Identity - Digital Signatures** | 74% | 26% |

*Source | Author's Own Sources*

**TABLE A3.15 | DBS - STAGE OF ADOPTION**

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Digital Identity - Digital Signatures** | 8% | 16% | 8% | 0% | 8% | 11% | 32% | 16% | 100% |
| **Digital Identity - Self-sovereign Identity** | 13% | 27% | 7% | 0% | 7% | 13% | 20% | 13% | 100% |
| **Biometrics - Voice/Speech** | 69% | 8% | 0% | 0% | 0% | 8% | 8% | 8% | 100% |
| **Biometrics - Eyes** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Face** | 3% | 23% | 3% | 3% | 3% | 23% | 23% | 19% | 100% |
| **Biometrics - Fingerprint/Palmprint** | 14% | 0% | 4% | 0% | 11% | 32% | 21% | 18% | 100% |
| **Biometrics - Hand Geometry (Gestures)** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Gait** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Heartbeat** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Keystrokes (Typing)** | 90% | 0% | 0% | 0% | 10% | 0% | 0% | 0% | 100% |
| **Biometrics - Odour** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - DNA** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Vascular (Vein)** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

## TABLE A3.15 | DBS - STAGE OF ADOPTION

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Sensors - Temperature** | 64% | 0% | 0% | 0% | 0% | 0% | 29% | 7% | 100% |
| **Sensors - Humidity** | 69% | 0% | 0% | 0% | 0% | 0% | 31% | 0% | 100% |
| **Sensors - Pressure: Ownership of Technological Solution** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Proximity: Ownership of Technological Solution** | 90% | 0% | 0% | 0% | 0% | 0% | 0% | 10% | 100% |
| **Sensors - Level** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Accelerometers** | 90% | 10% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Gyroscope** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Gas** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Infrared** | 90% | 0% | 0% | 0% | 0% | 0% | 0% | 10% | 100% |
| **Sensors - Optical** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.16 | DBS - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Digital Identity - Digital Signatures** | 9% | 60% | 9% | 23% | 0% | 0% | 100% |
| **Digital Identity - Self-sovereign Identity** | 21% | 29% | 36% | 14% | 0% | 0% | 100% |
| **Biometrics - Voice/Speech** | 67% | 25% | 0% | 8% | 0% | 0% | 100% |
| **Biometrics - Eyes** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Face** | 7% | 57% | 23% | 13% | 0% | 0% | 100% |
| **Biometrics - Fingerprint/Palmprint** | 15% | 70% | 15% | 0% | 0% | 0% | 100% |
| **Biometrics - Hand Geometry (Gestures)** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Gait** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Heartbeat** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Keystrokes (Typing)** | 89% | 11% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Odour** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - DNA** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Vascular (Vein)** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Temperature** | 62% | 38% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Humidity** | 67% | 33% | 0% | 0% | 0% | 0% | 100% |

**TABLE A3.16 | DBS - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Sensors - Pressure: Ownership of Technological Solution** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Proximity: Ownership of Technological Solution** | 89% | 11% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Level** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Accelerometers** | 89% | 0% | 0% | 0% | 0% | 11% | 100% |
| **Sensors - Gyroscope** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Gas** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Infrared** | 89% | 11% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Optical** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.17 | DBS - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Digital Identity - Digital Signatures** | 14% | 3% | 58% | 11% | 6% | 8% | 100% |
| **Digital Identity - Self-sovereign Identity** | 20% | 13% | 27% | 20% | 7% | 13% | 100% |
| **Biometrics - Voice/Speech** | 67% | 17% | 0% | 8% | 0% | 8% | 100% |
| **Biometrics - Eyes** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Face** | 0% | 23% | 40% | 20% | 7% | 10% | 100% |
| **Biometrics - Fingerprint/Palmprint** | 19% | 19% | 33% | 15% | 11% | 4% | 100% |
| **Biometrics - Hand Geometry (Gestures)** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Gait** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Heartbeat** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Keystrokes (Typing)** | 89% | 11% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Odour** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - DNA** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Biometrics - Vascular (Vein)** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Temperature** | 62% | 0% | 38% | 0% | 0% | 0% | 100% |

**TABLE A3.17 | DBS - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Sensors - Humidity** | 67% | 0% | 33% | 0% | 0% | 0% | 100% |
| **Sensors - Pressure: Ownership of Technological Solution** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Proximity: Ownership of Technological Solution** | 89% | 0% | 11% | 0% | 0% | 0% | 100% |
| **Sensors - Level** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Accelerometers** | 89% | 0% | 11% | 0% | 0% | 0% | 100% |
| **Sensors - Gyroscope** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Gas** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **Sensors - Infrared** | 89% | 0% | 11% | 0% | 0% | 0% | 100% |
| **Sensors - Optical** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.18 | CLOUD COMPUTING - APPLICABILITY**

|  | Yes | No |
|---|---|---|
| **IaaS - B2C** | 10% | 90% |
| **PaaS - B2C** | 11% | 89% |
| **PaaS - B2B** | 11% | 89% |
| **IaaS - B2B** | 13% | 87% |
| **SaaS - B2C** | 23% | 77% |
| **SaaS - B2B** | 32% | 68% |
| **IaaS for Internal Purposes** | 46% | 54% |
| **PaaS for Internal Purposes** | 49% | 51% |
| **SaaS for Internal Purposes** | 77% | 23% |

*Source | Author's Own Sources*

**TABLE A3.15 | CLOUD COMPUTING - STAGE OF ADOPTION**

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **SaaS - B2C** | 31% | 12% | 2% | 0% | 2% | 6% | 18% | 29% | 100% |
| **SaaS - B2B** | 15% | 9% | 6% | 0% | 6% | 6% | 26% | 33% | 100% |
| **PaaS - B2C** | 52% | 3% | 3% | 3% | 3% | 10% | 10% | 16% | 100% |
| **PaaS - B2B** | 50% | 3% | 3% | 0% | 0% | 6% | 16% | 22% | 100% |
| **SaaS - B2C** | 50% | 7% | 3% | 0% | 3% | 10% | 7% | 20% | 100% |
| **SaaS - B2B** | 49% | 9% | 3% | 0% | 0% | 9% | 11% | 20% | 100% |
| **SaaS for Internal Purposes** | 4% | 4% | 4% | 0% | 6% | 9% | 39% | 33% | 100% |
| **PaaS for Internal Purposes** | 12% | 5% | 10% | 1% | 6% | 10% | 23% | 35% | 100% |
| **IaaS for Internal Purposes** | 10% | 8% | 9% | 0% | 5% | 8% | 17% | 43% | 100% |

*Source | Author's Own Sources*

**TABLE A3.20 | CLOUD COMPUTING - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **SaaS - B2C** | 35% | 53% | 6% | 2% | 4% | 0% | 100% |
| **SaaS - B2B** | 22% | 63% | 6% | 4% | 6% | 0% | 100% |
| **PaaS - B2C** | 55% | 34% | 3% | 7% | 0% | 0% | 100% |
| **PaaS - B2B** | 50% | 44% | 3% | 3% | 0% | 0% | 100% |
| **SaaS - B2C** | 55% | 34% | 7% | 3% | 0% | 0% | 100% |
| **SaaS - B2B** | 51% | 37% | 6% | 6% | 0% | 0% | 100% |
| **SaaS for Internal Purposes** | 14% | 76% | 7% | 3% | 0% | 0% | 100% |
| **PaaS for Internal Purposes** | 18% | 65% | 10% | 6% | 1% | 0% | 100% |
| **IaaS for Internal Purposes** | 16% | 69% | 9% | 4% | 1% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.21 | CLOUND COMPUTING - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **SaaS - B2C** | 31% | 14% | 18% | 14% | 18% | 6% | 100% |
| **SaaS - B2B** | 17% | 22% | 22% | 17% | 13% | 9% | 100% |
| **PaaS - B2C** | 52% | 10% | 10% | 19% | 6% | 3% | 100% |
| **PaaS - B2B** | 50% | 6% | 6% | 13% | 13% | 13% | 100% |
| **SaaS - B2C** | 55% | 7% | 10% | 17% | 10% | 0% | 100% |
| **SaaS - B2B** | 46% | 3% | 20% | 23% | 9% | 0% | 100% |
| **SaaS for Internal Purposes** | 8% | 10% | 53% | 17% | 10% | 2% | 100% |
| **PaaS for Internal Purposes** | 13% | 8% | 42% | 23% | 8% | 5% | 100% |
| **IaaS for Internal Purposes** | 12% | 12% | 40% | 23% | 9% | 4% | 100% |

*Source | Author's Own Sources*

## TABLE A3.22 | CLOUND COMPUTING - PREVALENT DEPLOYMENT MODEL

| | No Information Available | Private cloud | Community cloud | Public cloud | Hybrid cloud | Total |
|---|---|---|---|---|---|---|
| **SaaS - B2C** | 39% | 7% | 0% | 39% | 15% | 100% |
| **SaaS - B2B** | 24% | 22% | 7% | 38% | 9% | 100% |
| **PaaS - B2C** | 48% | 15% | 0% | 30% | 7% | 100% |
| **PaaS - B2B** | 52% | 12% | 4% | 24% | 8% | 100% |
| **SaaS - B2C** | 54% | 13% | 0% | 25% | 8% | 100% |
| **SaaS - B2B** | 48% | 14% | 0% | 28% | 10% | 100% |
| **SaaS for Internal Purposes** | 16% | 40% | 2% | 39% | 4% | 100% |
| **PaaS for Internal Purposes** | 24% | 33% | 1% | 37% | 4% | 100% |
| **IaaS for Internal Purposes** | 22% | 33% | 0% | 38% | 7% | 100% |

*Source | Author's Own Sources*

**TABLE A3.23 | OTHER ENABLING TECHNOLOGY - APPLICABILITY**

|  | Yes | No |
|---|---|---|
| **Quantum Computing** | 0% | 100% |
| **AR and VR** | 2% | 98% |
| **GIS** | 9% | 91% |
| **RPA** | 20% | 80% |
| **Provision of a Digital Platform** | 38% | 62% |
| **Big Data and Data Analytics** | 45% | 55% |
| **WfMS** | 53% | 47% |
| **Web and Mobile applications** | 73% | 27% |

*Source | Author's Own Sources*

## TABLE A3.24 | OTHER ENABLING TECHNOLOGY - STAGE OF ADOPTION

| | No Information Available | In Exploration Phase | In Development Phase | In Testing Phase | Already in use, but low business relevance | Already in use, with basic business relevance | Already in use, with high business relevance | Already in use, inevitable for business model | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Web and Mobile applications** | 2% | 7% | 5% | 6% | 7% | 16% | 26% | 32% | 100% |
| **Big Data and Data Analytics** | 11% | 15% | 12% | 1% | 9% | 7% | 31% | 14% | 100% |
| **Quantum Computing** | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |
| **AR and VR** | 85% | 10% | 0% | 0% | 5% | 0% | 0% | 0% | 100% |
| **RPA** | 33% | 10% | 0% | 0% | 19% | 17% | 17% | 5% | 100% |
| **WfMS** | 8% | 12% | 7% | 2% | 10% | 11% | 28% | 22% | 100% |
| **Digital Platforms** | 15% | 9% | 6% | 6% | 11% | 11% | 20% | 23% | 100% |
| **GIS** | 54% | 0% | 0% | 0% | 7% | 18% | 14% | 7% | 100% |

*Source | Author's Own Sources*

**TABLE A3.25 | OTHER ENABLING TECHNOLOGY - TIME OF DEPLOYMENT**

| | No Information Available | Deployed as at end 2021 | Expected deployment in 2022 | Expected deployment in 2023 | Expected deployment in 2024 | Expected deployment in 2025 | Total |
|---|---|---|---|---|---|---|---|
| **Web and Mobile applications** | 8% | 75% | 10% | 6% | 1% | 0% | 100% |
| **Big Data and Data Analytics** | 17% | 57% | 7% | 11% | 8% | 0% | 100% |
| **Quantum Computing** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **AR and VR** | 89% | 5% | 0% | 0% | 5% | 0% | 100% |
| **RPA** | 33% | 48% | 10% | 10% | 0% | 0% | 100% |
| **WfMS** | 13% | 65% | 11% | 11% | 0% | 0% | 100% |
| **Digital Platforms** | 19% | 56% | 14% | 9% | 2% | 0% | 100% |
| **GIS** | 52% | 48% | 0% | 0% | 0% | 0% | 100% |

*Source | Author's Own Sources*

**TABLE A3.26 | OTHER ENABLING TECHNOLOGY - OWNERSHIP**

| | No Information Available | Technological solution largely developed and owned by the AP | Technological solution bought from third party | Technological solution used via partnership with third party | Partially developed in-house and partially bought | Partially developed in-house and partially used via partnership | Total |
|---|---|---|---|---|---|---|---|
| **Web and Mobile applications** | 6% | 36% | 31% | 12% | 11% | 5% | 100% |
| **Big Data and Data Analytics** | 14% | 36% | 15% | 14% | 15% | 6% | 100% |
| **Quantum Computing** | 100% | 0% | 0% | 0% | 0% | 0% | 100% |
| **AR and VR** | 90% | 0% | 0% | 5% | 5% | 0% | 100% |
| **RPA** | 37% | 14% | 26% | 5% | 16% | 2% | 100% |
| **WfMS** | 12% | 19% | 39% | 7% | 20% | 2% | 100% |
| **Digital Platforms** | 16% | 32% | 19% | 8% | 24% | 2% | 100% |
| **GIS** | 52% | 11% | 30% | 4% | 0% | 4% | 100% |

*Source | Author's Own Sources*

**TABLE A3.26 | STRENGTHS AND WEAKNESSES ACCORDING TO APS IN ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Strength | Weakness | Neutral | No Information |
|---|---|---|---|---|
| Access to the European Single Market | 34% | 3% | 36% | 27% |
| Availability and Access to Adequate IT Infrastructure | 31% | 5% | 42% | 23% |
| Maltese Regulatory Openness and Accessibility | 30% | 6% | 39% | 25% |
| Availability and Access to Supporting Services (e.g., Accounting, Legal) | 30% | 3% | 43% | 24% |
| Operational Costs in Malta | 28% | 13% | 36% | 24% |
| Setup Up Costs in Malta | 26% | 11% | 39% | 25% |
| Maltese Regulatory Processes | 24% | 13% | 40% | 23% |
| Formation of Business in Malta (including registration of legal personalities) | 24% | 6% | 45% | 25% |
| Availability and Access to Banking Products and/or Services | 24% | 19% | 33% | 24% |
| Maltese AML/CFT Legal Frameworks and Requirements (including KYC and Due Diligence) | 24% | 13% | 43% | 21% |
| Availability and Access to Third-Party Providers | 24% | 9% | 42% | 26% |
| Availability and Access to Skilled Workforce | 22% | 19% | 34% | 25% |
| Regulatory Costs in Malta | 22% | 16% | 38% | 25% |
| Maltese Data Privacy Frameworks and Requirements (including GDPR) | 22% | 4% | 52% | 22% |
| Availability and Access to Payment Infrastructure | 22% | 10% | 39% | 29% |
| Maltese Financial Services Legislative Frameworks - Legal Certainty | 19% | 7% | 46% | 28% |
| Residency and Relocation to Malta | 18% | 8% | 45% | 29% |
| Maltese Financial Services Legislative Frameworks and Requirements - Complexity | 17% | 8% | 48% | 27% |
| Maltese Regulatory Innovation Facilitators (including Regulatory Sandboxes) | 17% | 3% | 43% | 37% |

**TABLE A3.26 | STRENGTHS AND WEAKNESSES ACCORDING TO APS IN ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Strength | Weakness | Neutral | No Information |
|---|---|---|---|---|
| Availability and Access to Operational Infrastructure (other than those specifically mentioned) | 16% | 5% | 50% | 30% |
| Maltese Financial Services Legislative Frameworks - Proportionality | 15% | 10% | 46% | 28% |
| Maltese Regulatory Risk Appetite | 15% | 9% | 51% | 25% |
| Availability and Access to European FinTech Ecosystem (including potential partners) | 14% | 10% | 35% | 40% |
| Maltese Financial Services Sector - Consumer Demand Coming from Abroad | 14% | 5% | 49% | 32% |
| Maltese Financial Services Sector - Legacy Infrastructure and Systems | 13% | 8% | 48% | 31% |
| Availability and Access to Insurance Products | 12% | 8% | 41% | 40% |
| Availability and Access to Data (including that specified by law e.g., open banking under PSD II) - European | 12% | 8% | 39% | 41% |
| Maltese Financial Services Sector - Local Competition | 12% | 7% | 50% | 32% |
| Availability and Access to Local FinTech Ecosystem (including potential partners) | 11% | 12% | 37% | 41% |
| Maltese Geographical Factors | 11% | 11% | 48% | 30% |
| Availability and Access to Data (including that specified by law e.g., open banking under PSD II) - Local | 11% | 11% | 37% | 42% |
| Maltese Financial Services Sector - Competition from Abroad | 11% | 10% | 49% | 30% |
| Maltese Financial Services Sector - Consumer Demand Driven within Malta | 11% | 8% | 46% | 36% |
| Timing to Market in or from Malta | 11% | 9% | 43% | 37% |
| Maltese Financial Services Sector - Local Market Concentration | 10% | 8% | 49% | 32% |
| Availability and Access to Government Incentives, Grants and/or Subsidies | 10% | 8% | 38% | 44% |
| Financial Inclusion in Malta | 10% | 6% | 46% | 38% |
| Customer Financial Literacy in Malta | 9% | 12% | 40% | 39% |

**TABLE A3.26 | STRENGTHS AND WEAKNESSES ACCORDING TO APS IN ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Strength | Weakness | Neutral | No Information |
|---|---|---|---|---|
| **Availability and Access to Finance** | 9% | 10% | 36% | 45% |
| **Demography of Maltese Population** | 8% | 9% | 51% | 32% |
| **Maltese Political Factors** | 5% | 21% | 42% | 32% |

*Source | Author's Own Sources*

**TABLE A4.2 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| Availability and Access to Supporting Services (e.g., Accounting, Legal) | 28% | 37% | 37% | 21% | 28% | 29% | 36% |
| Availability and Access to Banking Products and/or Services | 33% | 34% | 23% | 14% | 31% | 22% | 18% |
| Availability and Access to Finance | 6% | 12% | 14% | 9% | 14% | 5% | 0% |
| Availability and Access to Insurance Products | 6% | 5% | 35% | 22% | 9% | 5% | 9% |
| Availability and Access to Payment Infrastructure | 33% | 29% | 26% | 22% | 22% | 17% | 18% |
| Availability and Access to Skilled Workforce | 33% | 27% | 33% | 17% | 18% | 21% | 18% |
| Availability and Access to Adequate IT Infrastructure | 50% | 29% | 42% | 22% | 23% | 33% | 18% |
| Availability and Access to Operational Infrastructure | 11% | 20% | 16% | 14% | 14% | 17% | 9% |
| Availability and Access to Third-Party Providers | 28% | 32% | 26% | 26% | 26% | 19% | 18% |
| Availability and Access to Data - Local | 11% | 24% | 9% | 10% | 14% | 6% | 18% |
| Availability and Access to Data - EU | 11% | 24% | 9% | 9% | 18% | 6% | 27% |
| Availability and Access to Government Incentives, Grants and/or Subsidies | 6% | 12% | 14% | 14% | 8% | 10% | 0% |
| Availability and Access to Local FinTech Ecosystem | 6% | 17% | 14% | 12% | 12% | 7% | 36% |
| Availability and Access to European FinTech Ecosystem | 22% | 32% | 14% | 9% | 14% | 10% | 27% |
| Access to the European Single Market | 50% | 51% | 35% | 28% | 34% | 26% | 82% |
| Setup Up Costs in Malta | 17% | 27% | 19% | 29% | 28% | 24% | 27% |
| Operational Costs in Malta | 11% | 22% | 21% | 34% | 28% | 29% | 27% |
| Regulatory Costs in Malta | 6% | 15% | 23% | 26% | 25% | 22% | 27% |

**TABLE A4.2 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Regulatory Openness and Accessibility** | 22% | 29% | 37% | 31% | 25% | 28% | 64% |
| **Maltese Regulatory Processes** | 17% | 22% | 26% | 29% | 23% | 22% | 45% |
| **Maltese Regulatory Risk Appetite** | 6% | 15% | 14% | 26% | 12% | 15% | 9% |
| **Maltese Regulatory Innovation Facilitators** | 28% | 24% | 16% | 17% | 12% | 15% | 18% |
| **Maltese Financial Services Legislative Frameworks and Requirements - Complexity** | 11% | 12% | 16% | 22% | 18% | 17% | 0% |
| **Maltese Financial Services Legislative Frameworks - Proportionality** | 11% | 12% | 14% | 19% | 12% | 17% | 0% |
| **Maltese Financial Services Legislative Frameworks - Legal Certainty** | 17% | 15% | 16% | 24% | 11% | 23% | 18% |
| **Maltese AML/CFT Legal Frameworks and Requirements** | 33% | 24% | 28% | 16% | 22% | 26% | 27% |
| **Maltese Data Privacy Frameworks and Requirements (including GDPR)** | 22% | 24% | 37% | 28% | 15% | 18% | 18% |
| **Financial Inclusion in Malta** | 11% | 7% | 9% | 7% | 9% | 13% | 9% |
| **Customer Financial Literacy in Malta** | 0% | 10% | 7% | 10% | 9% | 10% | 0% |
| **Timing to Market in or from Malta** | 17% | 12% | 7% | 7% | 12% | 13% | 0% |
| **Maltese Political Factors** | 6% | 2% | 2% | 5% | 9% | 5% | 0% |
| **Maltese Geographical Factors** | 11% | 24% | 16% | 14% | 2% | 8% | 27% |
| **Demography of Maltese Population** | 6% | 7% | 12% | 12% | 3% | 6% | 9% |
| **Formation of Business in Malta** | 28% | 17% | 16% | 26% | 34% | 24% | 18% |
| **Residency and Relocation to Malta** | 22% | 24% | 9% | 21% | 22% | 18% | 0% |
| **Maltese Financial Services Sector - Local Market Concentration** | 0% | 10% | 16% | 10% | 11% | 9% | 9% |

**TABLE A4.2 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Financial Services Sector - Local Competition** | 17% | 12% | 14% | 9% | 14% | 12% | 9% |
| **Maltese Financial Services Sector - Competition from Abroad** | 6% | 10% | 7% | 10% | 12% | 13% | 0% |
| **Maltese Financial Services Sector - Consumer Demand Driven within Malta** | 17% | 12% | 19% | 14% | 8% | 10% | 0% |
| **Maltese Financial Services Sector - Consumer Demand Coming from Abroad** | 6% | 24% | 14% | 14% | 11% | 13% | 18% |
| **Maltese Financial Services Sector - Legacy Infrastructure and Systems** | 6% | 5% | 16% | 21% | 12% | 13% | 0% |

*Source | Author's Own Sources*

**TABLE A4.3 | NEUTRALITY ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| Availability and Access to Supporting Services (e.g., Accounting, Legal) | 67% | 46% | 37% | 47% | 35% | 45% | 36% |
| Availability and Access to Banking Products and/or Services | 56% | 27% | 42% | 41% | 22% | 36% | 0% |
| Availability and Access to Finance | 56% | 46% | 37% | 31% | 28% | 43% | 18% |
| Availability and Access to Insurance Products | 67% | 49% | 40% | 36% | 34% | 48% | 9% |
| Availability and Access to Payment Infrastructure | 39% | 46% | 44% | 38% | 31% | 45% | 9% |
| Availability and Access to Skilled Workforce | 17% | 49% | 37% | 31% | 31% | 32% | 27% |
| Availability and Access to Adequate IT Infrastructure | 50% | 51% | 37% | 41% | 34% | 44% | 55% |
| Availability and Access to Operational Infrastructure | 72% | 59% | 53% | 50% | 38% | 50% | 64% |
| Availability and Access to Third-Party Providers | 50% | 44% | 44% | 40% | 32% | 48% | 45% |
| Availability and Access to Data - Local | 56% | 32% | 40% | 33% | 29% | 41% | 36% |
| Availability and Access to Data - EU | 72% | 41% | 40% | 34% | 26% | 45% | 36% |
| Availability and Access to Government Incentives, Grants and/or Subsidies | 39% | 39% | 47% | 33% | 35% | 41% | 45% |
| Availability and Access to Local FinTech Ecosystem | 50% | 46% | 40% | 36% | 29% | 38% | 18% |
| Availability and Access to European FinTech Ecosystem | 50% | 29% | 37% | 36% | 29% | 44% | 0% |
| Access to the European Single Market | 50% | 29% | 37% | 36% | 29% | 44% | 0% |
| Setup Up Costs in Malta | 44% | 44% | 49% | 28% | 31% | 44% | 45% |
| Operational Costs in Malta | 50% | 44% | 51% | 24% | 26% | 38% | 45% |
| Regulatory Costs in Malta | 44% | 49% | 40% | 29% | 35% | 39% | 36% |

**TABLE A4.3 | NEUTRALITY ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Regulatory Openness and Accessibility** | 50% | 51% | 40% | 28% | 37% | 43% | 27% |
| **Maltese Regulatory Processes** | 56% | 46% | 47% | 33% | 34% | 43% | 45% |
| **Maltese Regulatory Risk Appetite** | 67% | 61% | 60% | 36% | 43% | 54% | 73% |
| **Maltese Regulatory Innovation Facilitators** | 56% | 59% | 49% | 34% | 40% | 43% | 55% |
| **Maltese Financial Services Legislative Frameworks and Requirements - Complexity** | 67% | 66% | 53% | 33% | 37% | 50% | 91% |
| **Maltese Financial Services Legislative Frameworks - Proportionality** | 44% | 61% | 60% | 31% | 40% | 51% | 64% |
| **Maltese Financial Services Legislative Frameworks - Legal Certainty** | 56% | 68% | 58% | 28% | 42% | 48% | 55% |
| **Maltese AML/CFT Legal Frameworks and Requirements** | 44% | 54% | 49% | 48% | 32% | 43% | 45% |
| **Maltese Data Privacy Frameworks and Requirements (including GDPR)** | 61% | 71% | 44% | 40% | 46% | 57% | 64% |
| **Financial Inclusion in Malta** | 56% | 71% | 56% | 34% | 38% | 46% | 45% |
| **Customer Financial Literacy in Malta** | 50% | 46% | 56% | 34% | 29% | 39% | 55% |
| **Timing to Market in or from Malta** | 50% | 49% | 51% | 40% | 37% | 44% | 45% |
| **Maltese Political Factors** | 56% | 49% | 56% | 36% | 35% | 43% | 27% |
| **Maltese Geographical Factors** | 61% | 49% | 53% | 36% | 49% | 54% | 27% |
| **Demography of Maltese Population** | 50% | 63% | 56% | 41% | 51% | 52% | 36% |
| **Formation of Business in Malta** | 50% | 59% | 56% | 48% | 26% | 45% | 64% |
| **Residency and Relocation to Malta** | 39% | 51% | 56% | 47% | 35% | 43% | 64% |
| **Maltese Financial Services Sector - Local Market Concentration** | 72% | 61% | 58% | 55% | 40% | 45% | 45% |

**TABLE A4.3 | NEUTRALITY ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Financial Services Sector - Local Competition** | 56% | 61% | 60% | 59% | 38% | 45% | 55% |
| **Maltese Financial Services Sector - Competition from Abroad** | 61% | 59% | 60% | 53% | 38% | 43% | 64% |
| **Maltese Financial Services Sector - Consumer Demand Driven within Malta** | 44% | 61% | 53% | 52% | 37% | 43% | 27% |
| **Maltese Financial Services Sector - Consumer Demand Coming from Abroad** | 72% | 56% | 58% | 52% | 37% | 48% | 45% |
| **Maltese Financial Services Sector - Legacy Infrastructure and Systems** | 44% | 73% | 56% | 45% | 43% | 43% | 55% |

*Source | Author's Own Sources*

**TABLE A4.4 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| Availability and Access to Supporting Services (e.g., Accounting, Legal) | 0% | 7% | 2% | 0% | 2% | 4% | 18% |
| Availability and Access to Banking Products and/or Services | 11% | 24% | 9% | 7% | 15% | 23% | 73% |
| Availability and Access to Finance | 22% | 15% | 5% | 2% | 8% | 10% | 55% |
| Availability and Access to Insurance Products | 11% | 15% | 5% | 2% | 3% | 6% | 73% |
| Availability and Access to Payment Infrastructure | 28% | 12% | 2% | 2% | 8% | 10% | 64% |
| Availability and Access to Skilled Workforce | 44% | 17% | 9% | 19% | 9% | 24% | 45% |
| Availability and Access to Adequate IT Infrastructure | 0% | 10% | 2% | 2% | 5% | 6% | 9% |
| Availability and Access to Operational Infrastructure | 6% | 10% | 2% | 2% | 5% | 5% | 9% |
| Availability and Access to Third-Party Providers | 17% | 17% | 5% | 2% | 5% | 10% | 18% |
| Availability and Access to Data - Local | 28% | 24% | 12% | 12% | 5% | 10% | 18% |
| Availability and Access to Data - EU | 17% | 15% | 12% | 12% | 3% | 6% | 9% |
| Availability and Access to Government Incentives, Grants and/or Subsidies | 33% | 22% | 2% | 0% | 2% | 8% | 18% |
| Availability and Access to Local FinTech Ecosystem | 22% | 20% | 9% | 12% | 6% | 11% | 27% |
| Availability and Access to European FinTech Ecosystem | 11% | 15% | 9% | 12% | 5% | 8% | 36% |
| Access to the European Single Market | 0% | 5% | 0% | 0% | 3% | 4% | 0% |
| Setup Up Costs in Malta | 39% | 20% | 12% | 3% | 8% | 10% | 18% |
| Operational Costs in Malta | 39% | 24% | 12% | 3% | 12% | 13% | 18% |
| Regulatory Costs in Malta | 50% | 27% | 16% | 3% | 8% | 17% | 27% |

## TABLE A4.4 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Regulatory Openness and Accessibility** | 22% | 10% | 2% | 3% | 3% | 7% | 0% |
| **Maltese Regulatory Processes** | 22% | 22% | 9% | 3% | 9% | 15% | 0% |
| **Maltese Regulatory Risk Appetite** | 22% | 15% | 7% | 2% | 8% | 10% | 9% |
| **Maltese Regulatory Innovation Facilitators** | 6% | 7% | 2% | 0% | 0% | 6% | 0% |
| **Maltese Financial Services Legislative Frameworks and Requirements - Complexity** | 17% | 12% | 5% | 5% | 5% | 10% | 0% |
| **Maltese Financial Services Legislative Frameworks - Proportionality** | 33% | 17% | 0% | 5% | 8% | 10% | 18% |
| **Maltese Financial Services Legislative Frameworks - Legal Certainty** | 22% | 7% | 0% | 3% | 5% | 8% | 18% |
| **Maltese AML/CFT Legal Frameworks and Requirements** | 17% | 17% | 7% | 7% | 14% | 13% | 18% |
| **Maltese Data Privacy Frameworks and Requirements (including GDPR)** | 11% | 0% | 2% | 5% | 5% | 4% | 0% |
| **Financial Inclusion in Malta** | 11% | 7% | 0% | 0% | 5% | 10% | 18% |
| **Customer Financial Literacy in Malta** | 33% | 24% | 5% | 5% | 11% | 15% | 0% |
| **Timing to Market in or from Malta** | 22% | 20% | 2% | 3% | 6% | 10% | 18% |
| **Maltese Political Factors** | 39% | 37% | 14% | 10% | 15% | 23% | 45% |
| **Maltese Geographical Factors** | 22% | 17% | 7% | 5% | 9% | 11% | 36% |
| **Demography of Maltese Population** | 39% | 12% | 9% | 5% | 5% | 11% | 18% |
| **Formation of Business in Malta** | 11% | 12% | 7% | 2% | 5% | 6% | 0% |
| **Residency and Relocation to Malta** | 28% | 15% | 5% | 3% | 2% | 11% | 18% |
| **Maltese Financial Services Sector - Local Market Concentration** | 17% | 10% | 7% | 3% | 5% | 10% | 18% |

**TABLE A4.4 | STRENGTHS ACROSS AUTHORISATION SECTORS TOWARDS ADOPTING ENABLING AND INNOVATIVE TECHNOLOGIES**

| | CIs | FIs | Insurance Intermediaries | Insurance Undertakings and P.C.C. | IFs | ISPs | VFAs |
|---|---|---|---|---|---|---|---|
| **Maltese Financial Services Sector - Local Competition** | 17% | 7% | 7% | 3% | 3% | 8% | 9% |
| **Maltese Financial Services Sector - Competition from Abroad** | 28% | 20% | 7% | 3% | 8% | 11% | 27% |
| **Maltese Financial Services Sector - Consumer Demand Driven within Malta** | 28% | 7% | 7% | 2% | 6% | 7% | 36% |
| **Maltese Financial Services Sector - Consumer Demand Coming from Abroad** | 17% | 2% | 2% | 2% | 6% | 5% | 18% |
| **Maltese Financial Services Sector - Legacy Infrastructure and Systems** | 39% | 7% | 9% | 3% | 3% | 10% | 18% |

*Source | Author's Own Sources*

**TABLE A4.5 | INFLUENCE OF DIGITAL TRANSFORMATION ON FINANCIAL SERVICES**

| | No Information | Not Influential | Slightly Influential | Somewhat Influential | Very Influential | Extremely Influential |
|---|---|---|---|---|---|---|
| **Banking - Commercial Banking** | 27% | 6% | 4% | 15% | 33% | 15% |
| **Banking - Wholesale Banking** | 31% | 7% | 6% | 17% | 28% | 12% |
| **Capital Market Infrastructures - Central Securities Depositories & Clearing and Settlement Systems** | 36% | 8% | 5% | 18% | 23% | 10% |
| **Capital Market Infrastructures - Other** | 62% | 7% | 4% | 12% | 10% | 5% |
| **Capital Market Infrastructures - Trading Venues** | 38% | 7% | 5% | 15% | 22% | 12% |
| **Credit Intermediation** | 38% | 7% | 6% | 18% | 22% | 9% |
| **Fund Administration** | 34% | 7% | 7% | 24% | 21% | 8% |
| **Fund Management and Servicing (e.g. Custody/Depositories)** | 34% | 7% | 8% | 20% | 22% | 9% |
| **Insurance Intermediaries** | 42% | 5% | 9% | 18% | 17% | 10% |
| **Investment Services** | 28% | 7% | 8% | 22% | 23% | 11% |
| **Payment Infrastructures** | 27% | 6% | 3% | 9% | 32% | 24% |
| **Payments Services and Electronic Money** | 26% | 6% | 3% | 9% | 28% | 29% |
| **Re/Insurance - Claims Handling** | 41% | 5% | 7% | 21% | 16% | 10% |
| **Re/Insurance - Other** | 63% | 6% | 6% | 13% | 8% | 5% |

*Source | Author's Own Sources*

**TABLE A4.6 | IMPACT OF DIGITAL TRANSFORMATION ON FINANCIAL SERVICES**

| | No Information | High Negative Impact | Low Negative Impact | Low Positive Impact | High Positive Impact |
|---|---|---|---|---|---|
| **Banking - Commercial Banking** | 7% | 1% | 3% | 32% | 58% |
| **Banking - Wholesale Banking** | 11% | 0% | 4% | 38% | 47% |
| **Capital Market Infrastructures - Central Securities Depositories & Clearing and Settlement Systems** | 12% | 0% | 4% | 39% | 45% |
| **Capital Market Infrastructures - Other** | 13% | 0% | 2% | 40% | 46% |
| **Capital Market Infrastructures - Trading Venues** | 11% | 0% | 4% | 36% | 50% |
| **Credit Intermediation** | 11% | 1% | 3% | 42% | 43% |
| **Fund Administration** | 9% | 0% | 4% | 43% | 44% |
| **Fund Management and Servicing (e.g. Custody/Depositories)** | 9% | 0% | 4% | 47% | 40% |
| **Insurance Intermediaries** | 9% | 1% | 3% | 37% | 50% |
| **Investment Services** | 6% | 0% | 3% | 46% | 45% |
| **Payment Infrastructures** | 5% | 0% | 3% | 27% | 66% |
| **Payments Services and Electronic Money** | 5% | 0% | 2% | 22% | 71% |
| **Re/Insurance - Claims Handling** | 10% | 1% | 5% | 38% | 47% |
| **Re/Insurance - Other** | 10% | 0% | 6% | 37% | 47% |

*Source | Author's Own Sources*

**TABLE A4.7 | INFLUENCE OF ENABLING TECHNOLOGY AND INNOVATIONS**

| | No Information | Not Influential | Slightly Influential | Somewhat Influential | Very Influential | Extremely Influential |
|---|---|---|---|---|---|---|
| DLT | 39% | 8% | 10% | 15% | 22% | 7% |
| AI AND ML | 29% | 3% | 9% | 18% | 30% | 12% |
| Big Data and Data Analytics | 27% | 2% | 6% | 16% | 30% | 19% |
| DBS | 30% | 3% | 10% | 19% | 25% | 13% |
| API | 28% | 2% | 6% | 14% | 26% | 25% |
| Cloud Computing | 21% | 1% | 4% | 18% | 29% | 26% |
| Quantum Computing | 46% | 10% | 6% | 17% | 13% | 8% |
| AR and VR | 45% | 21% | 11% | 13% | 9% | 1% |
| RPA | 45% | 6% | 10% | 17% | 16% | 6% |
| WfMS | 30% | 4% | 8% | 21% | 26% | 10% |
| Web and Mobile Applications | 24% | 4% | 3% | 18% | 29% | 22% |
| GIS | 42% | 8% | 14% | 17% | 15% | 6% |
| Provision of a Digital Platform | 32% | 1% | 9% | 19% | 25% | 14% |
| Internet of Things | 38% | 10% | 11% | 17% | 14% | 10% |
| DeFi | 40% | 8% | 12% | 14% | 18% | 8% |
| Tailored Finance | 46% | 6% | 12% | 17% | 14% | 6% |
| Autonomous Finance | 49% | 9% | 10% | 14% | 12% | 6% |
| Open Architecture | 42% | 4% | 12% | 17% | 16% | 9% |
| RegTech | 37% | 5% | 8% | 17% | 21% | 12% |

**TABLE A4.7 | INFLUENCE OF ENABLING TECHNOLOGY AND INNOVATIONS**

| | No Information | Not Influential | Slightly Influential | Somewhat Influential | Very Influential | Extremely Influential |
|---|---|---|---|---|---|---|
| **SupTech** | 51% | 5% | 6% | 17% | 13% | 9% |
| **FinTech-as-a-Service** | 39% | 5% | 6% | 13% | 26% | 11% |
| **Platformisation** | 46% | 3% | 9% | 16% | 18% | 9% |
| **Embedded Finance** | 51% | 3% | 10% | 14% | 16% | 6% |
| **BigTech** | 51% | 3% | 9% | 12% | 17% | 9% |
| **Metaverse** | 48% | 12% | 12% | 15% | 9% | 4% |
| **DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc)** | 42% | 8% | 7% | 15% | 18% | 9% |
| **Alternative Currencies** | 42% | 11% | 9% | 16% | 15% | 7% |

*Source | Author's Own Sources*

**TABLE A4.8 | IMPACT OF ENABLING TECHNOLOGY AND INNOVATIONS**

| | No Information | High Negative Impact | Low Negative Impact | Low Positive Impact | High Positive Impact |
|---|---|---|---|---|---|
| DLT | 7% | 1% | 3% | 45% | 45% |
| AI AND ML | 8% | 0% | 2% | 39% | 51% |
| Big Data and Data Analytics | 6% | 0% | 0% | 34% | 60% |
| DBS | 10% | 0% | 2% | 39% | 48% |
| API | 7% | 0% | 1% | 32% | 60% |
| Cloud Computing | 6% | 0% | 2% | 30% | 62% |
| Quantum Computing | 16% | 0% | 4% | 47% | 34% |
| AR and VR | 17% | 1% | 12% | 47% | 24% |
| RPA | 14% | 0% | 4% | 41% | 41% |
| WfMS | 9% | 0% | 1% | 40% | 50% |
| Web and Mobile Applications | 6% | 0% | 1% | 35% | 58% |
| GIS | 12% | 0% | 3% | 50% | 35% |
| Provision of a Digital Platform | 9% | 0% | 3% | 42% | 47% |
| Internet of Things | 13% | 1% | 3% | 46% | 38% |
| DeFi | 13% | 1% | 5% | 51% | 30% |
| Tailored Finance | 14% | 1% | 3% | 58% | 25% |
| Autonomous Finance | 17% | 0% | 3% | 48% | 32% |
| Open Architecture | 14% | 0% | 5% | 51% | 31% |
| RegTech | 9% | 1% | 4% | 44% | 43% |

**TABLE A4.8 | IMPACT OF ENABLING TECHNOLOGY AND INNOVATIONS**

| | No Information | High Negative Impact | Low Negative Impact | Low Positive Impact | High Positive Impact |
|---|---|---|---|---|---|
| SupTech | 11% | 1% | 4% | 45% | 39% |
| FinTech-as-a-Service | 10% | 1% | 3% | 46% | 41% |
| Platformisation | 8% | 1% | 3% | 50% | 39% |
| Embedded Finance | 12% | 0% | 4% | 54% | 30% |
| BigTech | 14% | 3% | 7% | 39% | 38% |
| Metaverse | 17% | 1% | 13% | 51% | 19% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 10% | 3% | 15% | 39% | 33% |
| Alternative Currencies | 13% | 5% | 16% | 34% | 32% |

*Source | Author's Own Sources*

**TABLE A4.9 | CYBER RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| DLT | 57% | 14% | 13% | 10% | 6% |
| AI and ML | 49% | 16% | 19% | 11% | 5% |
| Big Data and Data Analytics | 44% | 20% | 20% | 10% | 6% |
| DBS | 45% | 17% | 22% | 7% | 9% |
| API | 38% | 18% | 23% | 15% | 6% |
| Cloud Computing | 26% | 15% | 28% | 19% | 11% |
| Quantum Computing | 68% | 10% | 12% | 4% | 6% |
| AR and VR | 70% | 11% | 11% | 5% | 3% |
| RPA | 62% | 17% | 13% | 5% | 2% |
| WfMS | 42% | 27% | 24% | 5% | 2% |
| Web and Mobile Applications | 32% | 14% | 26% | 20% | 8% |
| GIS | 64% | 13% | 15% | 5% | 2% |
| Internet of Things | 65% | 9% | 10% | 12% | 4% |
| DeFi | 61% | 12% | 14% | 10% | 4% |
| Tailored Finance | 67% | 16% | 11% | 5% | 1% |
| Autonomous Finance | 65% | 12% | 14% | 7% | 2% |
| Open Architecture | 61% | 13% | 14% | 7% | 4% |
| RegTech | 52% | 21% | 19% | 5% | 2% |

**TABLE A4.9 | CYBER RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 62% | 17% | 13% | 6% | 2% |
| FinTech-as-a-Service | 57% | 13% | 20% | 7% | 4% |
| Platformisation | 55% | 14% | 20% | 9% | 3% |
| Embedded Finance | 67% | 12% | 13% | 6% | 2% |
| BigTech | 64% | 11% | 13% | 9% | 3% |
| Metaverse | 70% | 7% | 12% | 6% | 5% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 63% | 8% | 11% | 9% | 9% |
| Alternative Currencies | 62% | 9% | 10% | 10% | 10% |

*Source | Author's Own Sources*

**TABLE A4.10 | OPERATIONAL RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

|  | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| **DLT** | 58% | 17% | 14% | 10% | 1% |
| **AI and ML** | 50% | 19% | 19% | 10% | 2% |
| **Big Data and Data Analytics** | 43% | 26% | 19% | 10% | 2% |
| **DBS** | 47% | 21% | 22% | 7% | 2% |
| **API** | 39% | 24% | 25% | 9% | 3% |
| **Cloud Computing** | 27% | 27% | 26% | 13% | 6% |
| **Quantum Computing** | 69% | 15% | 10% | 5% | 2% |
| **AR and VR** | 71% | 14% | 10% | 4% | 1% |
| **RPA** | 61% | 16% | 14% | 7% | 2% |
| **WfMS** | 41% | 29% | 22% | 7% | 1% |
| **Web and Mobile Applications** | 34% | 21% | 27% | 15% | 4% |
| **GIS** | 65% | 16% | 15% | 4% | 1% |
| **Internet of Things** | 65% | 12% | 16% | 7% | 1% |
| **DeFi** | 61% | 12% | 16% | 9% | 1% |
| **Tailored Finance** | 66% | 13% | 15% | 5% | 1% |
| **Autonomous Finance** | 66% | 12% | 13% | 8% | 1% |
| **Open Architecture** | 61% | 15% | 15% | 7% | 2% |
| **RegTech** | 53% | 24% | 16% | 5% | 1% |

**TABLE A4.10 | OPERATIONAL RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 61% | 21% | 10% | 6% | 2% |
| FinTech-as-a-Service | 58% | 16% | 17% | 7% | 2% |
| Platformisation | 56% | 18% | 20% | 5% | 2% |
| Embedded Finance | 67% | 13% | 13% | 4% | 2% |
| BigTech | 65% | 13% | 14% | 7% | 1% |
| Metaverse | 71% | 9% | 13% | 4% | 3% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 64% | 8% | 13% | 9% | 5% |
| Alternative Currencies | 64% | 8% | 15% | 6% | 6% |

*Source | Author's Own Sources*

**TABLE A4.11 | REPUTATIONAL RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| DLT | 61% | 18% | 13% | 5% | 4% |
| AI and ML | 50% | 21% | 18% | 8% | 2% |
| Big Data and Data Analytics | 51% | 24% | 16% | 6% | 3% |
| DBS | 50% | 24% | 18% | 3% | 5% |
| API | 45% | 29% | 19% | 4% | 3% |
| Cloud Computing | 35% | 29% | 22% | 9% | 4% |
| Quantum Computing | 71% | 15% | 8% | 4% | 2% |
| AR and VR | 70% | 14% | 12% | 3% | 1% |
| RPA | 63% | 18% | 14% | 2% | 2% |
| WfMS | 48% | 30% | 16% | 5% | 1% |
| Web and Mobile Applications | 37% | 22% | 26% | 11% | 4% |
| GIS | 65% | 18% | 14% | 2% | 1% |
| Internet of Things | 66% | 14% | 13% | 7% | 1% |
| DeFi | 64% | 15% | 12% | 7% | 3% |
| Tailored Finance | 67% | 14% | 13% | 5% | 1% |
| Autonomous Finance | 66% | 12% | 14% | 5% | 3% |
| Open Architecture | 64% | 15% | 17% | 3% | 1% |
| RegTech | 56% | 22% | 17% | 2% | 3% |

**TABLE A4.11 | REPUTATIONAL RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 62% | 19% | 12% | 4% | 3% |
| FinTech-as-a-Service | 60% | 16% | 16% | 7% | 2% |
| Platformisation | 58% | 16% | 20% | 4% | 1% |
| Embedded Finance | 67% | 12% | 13% | 6% | 1% |
| BigTech | 65% | 14% | 14% | 5% | 2% |
| Metaverse | 69% | 10% | 13% | 5% | 3% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 63% | 10% | 9% | 9% | 8% |
| Alternative Currencies | 62% | 10% | 11% | 9% | 8% |

*Source | Author's Own Sources*

**TABLE A4.12 | MARKET RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| DLT | 67% | 16% | 12% | 3% | 1% |
| AI and ML | 59% | 21% | 14% | 5% | 1% |
| Big Data and Data Analytics | 56% | 24% | 14% | 5% | 1% |
| DBS | 62% | 26% | 10% | 1% | 0% |
| API | 55% | 30% | 11% | 3% | 1% |
| Cloud Computing | 51% | 31% | 13% | 4% | 1% |
| Quantum Computing | 76% | 12% | 8% | 2% | 1% |
| AR and VR | 78% | 11% | 8% | 2% | 0% |
| RPA | 70% | 19% | 8% | 2% | 1% |
| WfMS | 60% | 26% | 11% | 2% | 1% |
| Web and Mobile Applications | 53% | 24% | 17% | 4% | 1% |
| GIS | 69% | 17% | 11% | 2% | 1% |
| Internet of Things | 71% | 12% | 11% | 5% | 0% |
| DeFi | 66% | 13% | 14% | 4% | 2% |
| Tailored Finance | 69% | 15% | 12% | 4% | 1% |
| Autonomous Finance | 70% | 13% | 12% | 4% | 1% |
| Open Architecture | 69% | 16% | 13% | 2% | 1% |
| RegTech | 64% | 22% | 11% | 2% | 1% |

**TABLE A4.12 | MARKET RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 70% | 17% | 10% | 2% | 1% |
| FinTech-as-a-Service | 67% | 18% | 13% | 2% | 1% |
| Platformisation | 64% | 17% | 15% | 3% | 1% |
| Embedded Finance | 71% | 14% | 12% | 2% | 1% |
| BigTech | 71% | 13% | 12% | 3% | 1% |
| Metaverse | 75% | 11% | 11% | 3% | 0% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 67% | 11% | 9% | 8% | 5% |
| Alternative Currencies | 67% | 10% | 8% | 8% | 6% |

*Source | Author's Own Sources*

## TABLE A4.13 | CREDIT RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| DLT | 73% | 16% | 9% | 2% | 1% |
| AI and ML | 67% | 19% | 10% | 3% | 1% |
| Big Data and Data Analytics | 64% | 22% | 11% | 2% | 1% |
| DBS | 67% | 19% | 12% | 1% | 0% |
| API | 62% | 25% | 10% | 2% | 1% |
| Cloud Computing | 58% | 27% | 11% | 3% | 1% |
| Quantum Computing | 81% | 11% | 6% | 1% | 1% |
| AR and VR | 81% | 10% | 7% | 1% | 1% |
| RPA | 75% | 15% | 9% | 1% | 1% |
| WfMS | 61% | 26% | 11% | 1% | 1% |
| Web and Mobile Applications | 57% | 26% | 12% | 4% | 1% |
| GIS | 74% | 16% | 8% | 2% | 0% |
| Internet of Things | 76% | 12% | 10% | 2% | 0% |
| DeFi | 66% | 13% | 13% | 6% | 1% |
| Tailored Finance | 68% | 13% | 13% | 4% | 1% |
| Autonomous Finance | 70% | 11% | 13% | 5% | 1% |
| Open Architecture | 71% | 16% | 10% | 1% | 1% |
| RegTech | 66% | 20% | 10% | 2% | 1% |

**TABLE A4.13 | CREDIT RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 72% | 17% | 9% | 1% | 1% |
| FinTech-as-a-Service | 69% | 15% | 13% | 2% | 2% |
| Platformisation | 69% | 17% | 10% | 2% | 1% |
| Embedded Finance | 72% | 13% | 11% | 2% | 1% |
| BigTech | 72% | 14% | 10% | 2% | 1% |
| Metaverse | 78% | 9% | 10% | 2% | 1% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 69% | 10% | 14% | 3% | 5% |
| Alternative Currencies | 67% | 10% | 13% | 5% | 5% |

*Source | Author's Own Sources*

**TABLE A4.14 | LEVERAGE RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| **DLT** | 72% | 17% | 8% | 2% | 1% |
| **AI and ML** | 68% | 18% | 10% | 3% | 1% |
| **Big Data and Data Analytics** | 65% | 21% | 10% | 2% | 1% |
| **DBS** | 67% | 22% | 10% | 1% | 1% |
| **API** | 63% | 24% | 9% | 3% | 1% |
| **Cloud Computing** | 59% | 28% | 9% | 3% | 1% |
| **Quantum Computing** | 80% | 12% | 6% | 1% | 1% |
| **AR and VR** | 81% | 10% | 7% | 2% | 0% |
| **RPA** | 76% | 14% | 8% | 1% | 1% |
| **WfMS** | 65% | 24% | 8% | 2% | 1% |
| **Web and Mobile Applications** | 59% | 25% | 12% | 3% | 1% |
| **GIS** | 75% | 16% | 6% | 2% | 0% |
| **Internet of Things** | 77% | 12% | 9% | 3% | 0% |
| **DeFi** | 69% | 12% | 10% | 7% | 2% |
| **Tailored Finance** | 71% | 13% | 11% | 4% | 1% |
| **Autonomous Finance** | 72% | 12% | 10% | 4% | 2% |
| **Open Architecture** | 73% | 15% | 8% | 3% | 1% |
| **RegTech** | 70% | 18% | 9% | 2% | 1% |

## TABLE A4.14 | LEVERAGE RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| **SupTech** | 74% | 15% | 8% | 2% | 1% |
| **FinTech-as-a-Service** | 72% | 15% | 10% | 2% | 1% |
| **Platformisation** | 73% | 15% | 8% | 3% | 1% |
| **Embedded Finance** | 73% | 12% | 12% | 2% | 1% |
| **BigTech** | 75% | 13% | 7% | 5% | 0% |
| **Metaverse** | 78% | 8% | 10% | 3% | 1% |
| **DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc)** | 71% | 11% | 10% | 5% | 3% |
| **Alternative Currencies** | 70% | 10% | 10% | 7% | 4% |

*Source | Author's Own Sources*

**TABLE A4.15 | LIQUIDITY RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| DLT | 71% | 16% | 10% | 2% | 1% |
| AI and ML | 64% | 21% | 12% | 2% | 1% |
| Big Data and Data Analytics | 62% | 25% | 10% | 2% | 1% |
| DBS | 67% | 23% | 8% | 1% | 1% |
| API | 59% | 27% | 10% | 2% | 1% |
| Cloud Computing | 56% | 31% | 9% | 3% | 1% |
| Quantum Computing | 80% | 11% | 7% | 1% | 1% |
| AR and VR | 80% | 12% | 6% | 1% | 1% |
| RPA | 74% | 16% | 8% | 1% | 1% |
| WfMS | 61% | 26% | 10% | 2% | 1% |
| Web and Mobile Applications | 55% | 28% | 12% | 3% | 1% |
| GIS | 72% | 19% | 5% | 2% | 1% |
| Internet of Things | 75% | 15% | 8% | 2% | 0% |
| DeFi | 70% | 13% | 9% | 6% | 2% |
| Tailored Finance | 69% | 16% | 9% | 4% | 1% |
| Autonomous Finance | 69% | 13% | 11% | 5% | 2% |
| Open Architecture | 71% | 16% | 11% | 1% | 1% |
| RegTech | 66% | 21% | 10% | 2% | 2% |

**TABLE A4.15 | LIQUIDITY RISK ACROSS ENABLING AND INNOVATIVE TECHNOLOGIES**

| | Not Applicable | No increase in Risk | Low increase in Risk | Medium increase in Risk | High increase in Risk |
|---|---|---|---|---|---|
| SupTech | 71% | 18% | 8% | 2% | 2% |
| FinTech-as-a-Service | 67% | 18% | 12% | 1% | 2% |
| Platformisation | 66% | 18% | 12% | 2% | 1% |
| Embedded Finance | 71% | 14% | 12% | 2% | 1% |
| BigTech | 73% | 14% | 10% | 2% | 1% |
| Metaverse | 77% | 9% | 10% | 3% | 1% |
| DLT Assets and Tokenisation of Asset Using DLT (including Crypto Assets, Stable Coins, NFTs, CBDC, etc) | 68% | 10% | 12% | 5% | 5% |
| Alternative Currencies | 66% | 9% | 13% | 6% | 6% |

*Source | Author's Own Sources*

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