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Abstract	**NGI TETRA** is an EU-funded project tasked with the mission to serve as a business accelerator for Next Generation Internet (NGI) projects. This report has been elaborated in the context of NGI TETRA with the aim of exploring

	current and future trends expected to shape the future of NGI business. Our quest for exploration built and expanded on the knowledge base created during the initial phase of NGI TETRA by means of desk research and in-depth interviews. The **desk research** entailed a literature review of existing evidence on the NGI, mapping ecosystems and business needs as well as on the business models and trends that appear to be driving the commercialisation of NGI innovations. The findings from the review of the literature were further discussed and calibrated through a series of **12 in-depth interviews**, conducted with NGI experts across Europe, revealing additional meaningful insights into (potential) **technology and business trends of the future**. Eventually, the findings we unearthed through our desk research and interviews were analysed, producing relevant **conclusions and implications for NGI beneficiaries** and stakeholders.
Keywords	Next Generation Internet, TETRA, business models, trends

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EXECUTIVE SUMMARY

NGI TETRA is an EU-funded project tasked with the mission to serve as a business accelerator for Next Generation Internet (NGI) projects. To this end, the project offers a wide range of business support services with a view to turning NGI research results into marketable products and services that sustainably solve real world problems. In this context, this report is titled "**Future trends on NGI business models and related aspects**" and has been elaborated with the aim of exploring current and future trends expected to shape the future of NGI business.

Our quest for exploration built and expanded on the knowledge base created during the initial phase of NGI TETRA by means of desk research and in-depth interviews. The **desk research** entailed a literature review of existing evidence on the NGI, mapping ecosystems and business needs as well as on the business models and trends that appear to be driving the commercialisation of NGI innovations. The findings from the review of the literature were further discussed and calibrated through a series of **12 in-depth interviews**, conducted with NGI experts across Europe, revealing additional meaningful insights into (potential) **technology and business trends of the future**. Eventually, the findings we unearthed through our desk research and interviews were analysed, producing relevant **conclusions and implications for NGI beneficiaries** and stakeholders.

Along these lines, the remainder of this executive summary offers a concise overview of the results and key insights stemming from our exploratory study, with further details being elaborated in the actual report which follows right after.

The NGI and its business needs

The **NGI** is an initiative of the European Commission (EC) that aims to shape the development and evolution of the internet into an **Internet of Humans**[1]. The initiative is founded upon five pillars including: (i) **Democracy**, (ii) **Resilience**, (iii) **Sustainability**, (iv) **Trust**, and (v) **Inclusion**, under which a wider a range of topics are covered (e.g. raising the level of safeguards against hacking and cyberattacks, giving better accessibility to people with disabilities, decentralizing data governance). In line with these pillars and to mobilize relevant stakeholders across Europe, **funding for the NGI started in 2018 through Horizon 2020**, financially backing 15 projects so far (by mid-2021). Through these projects, the NGI initiative funds and **supports Research and Innovation (R&I) for NGI solutions** being developed by talented innovators in line with the NGI values and vision (such as SMEs and start-ups), while at the same time building a European NGI ecosystem.

Currently, **the NGI ecosystem is a vibrant community with over 590 members**, including researchers, executives, civil society participants as well as major private and public stakeholders[2]. These innovators, also known as NGI beneficiaries, serve as **agents of change** by developing a wide and diverse mix of innovations for the

[1] The NGI Initiative: An Internet of Humans. Next Generation Internet. https://www.ngi.eu/about/.
[2] NGI Outreach Office. Next Generation Internet. https://www.ngi.eu/ngi-outreach-office/.

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NGI (distributed ledger and decentralised solutions, blockchain, communication services and applications, cryptography, artificial intelligence, etc.). At the same time, however they face **challenges when it comes to bringing NGI innovations to market**. Our findings indicate that NGI beneficiaries need tailored support (e.g. advice, mentoring and training) in order to effectively transform their results into marketable solutions that meet customer needs and requirements. They need to build / improve the **entrepreneurial skills and resources** (e.g. business strategy definition, management, access to funding) required to foster the sustainability of their businesses in a rapidly changing and competitive market environment.

Current NGI business models and future trends

In order to address their business needs, NGI beneficiaries appear to employ an **astounding diversity of business models**, with our literature review identifying 80 different types. These business models were screened based on their relevance to the NGI pillars as well as on the prospect of adoption amongst NGI beneficiaries, leading us to analyse more in-depth a total of 18 different types of NGI business models. The findings from our analysis, calibrated through a short-scale survey of NGI beneficiaries supported by NGI TETRA and validated by the insights we collected from our interviews with NGI experts, indicate that, at the moment, the **predominant NGI business models** seem to be: (i) Software as a Service (SaaS); (ii) Open source with revenue sources; (iii) Subscription; (iv) Freemium; and (iv) Token-related models including Non-fungible Tokens (NFTs).

All of these business model types have the potential to contribute towards the development of the NGI, providing pathways for viable business operations in line with NGI values. Given that each one comes with its own blend of pros and cons, **NGI businesses need to be strategic when selecting their business model**. The individual characteristics and needs of their business as well as the particular needs of their target customers (be they consumers, businesses or other public / private organizations) should be carefully considered. Along these lines, our findings highlight the importance of **customer-centricity**. This approach has the potential to help businesses not only to understand what is valued by their (prospective) customers, but also what customers are willing to pay for this value, ultimately allowing them to select an appropriate business model. In doing so, they can also **direct their value propositions towards real world demand**, while at the same time abiding by the values of the NGI and creating actual impact.

With an outlook to the future, our findings provide evidence that attests to the **confluence of diverse factors expected to influence NGI business models**, driven by dynamic technological, economic, legal, policy and social dimensions. Such factors include: (i) **technological advances and megatrends** that seem to drive and enable progress in different NGI areas (such as artificial intelligence, extended reality, Big Data, cloud computing and communication technologies, etc.); (ii) the **growing need for better cybersecurity and privacy preservation** in line with EU regulation as well as the pillars of the NGI; (iii) the impact of the **COVID-19 pandemic which has accelerated progress and change**; as well as (iv) future business models pathways in the context of the EU, which seem to gravitate towards more **open and blended business models** that have the potential to enable innovators to offer NGI services well-adapted to customer needs (e.g. business models based on on-demand services and/or ecosystems).

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Conclusions

Building upon tested business models can open viable pathways for growth: There are already many different business models that NGI beneficiaries can use to open up viable pathways for commercialisation and growth. Shining examples and success stories of businesses employing such models in practice to commercialise a wide array of solutions have familiarised many diverse market sectors and customers with them. As such, these models offer a trustworthy approach for starting and scaling up NGI business, along with the option to adapt and evolve into other models as market demand and conditions change in the future (e.g. on-demand services or ecosystem-based business models).

Major technology trends re-shape our world offering promising opportunities: The findings from our study leave little room for debate about the business opportunities that current trends pose for NGI beneficiaries to develop and deliver compelling value propositions (e.g. AI-powered optimisation, cloud robotics, autonomous cooperative machines, multi-user AR experiences, predictive analytics, etc.). The race to seize these opportunities is on with many innovators competing to gain and keep the lead. In this context, disruptive innovation can be key for businesses that want to jump into the fray and remain sustainable in the longer term, with a view to securing a place in the NGI value chains of the future.

Innovation is key in NGI, yet it should also be accompanied by a mindset shift: Technological innovation, albeit crucial, is only part of the equation in NGI business. NGI beneficiaries aspiring to commercialize their solutions need to shift their way of thinking and develop an entrepreneurial mindset as well. This way of thinking can help them identify opportunities that lie within research questions and technical problems along with pathways for growth. A crucial component for growth in this context is the creation of a strong network. Our findings indicate that it is vital for NGI innovators to build good partnerships with other actors, be aware of what they are doing and seek to complement instead of competing.

Exploring customer-centric business models aligned with the NGI pillars: Finding the proper business model is not easy. NGI beneficiaries need to factor in multiple dimensions while designing their business model, and approach this as a continuous process of exploration and improvement, rather than a one-off decision. Our study showed that placing customers and their needs at the center of business model design can be key for generating revenues (and profits). In the context of the NGI, however, this should only be a part of the bigger picture. Alignment with the foundational values of the NGI is important as well, with a view to avoiding externalities that adversely impact our environment or society.

Joining forces for a NGI that resonates with EU ethical and social values: The NGI brings forth ethical and social dimensions which need to be embedded in NGI business models. With risks such as cybersecurity threats and personal data breaches looming over them, NGI businesses need to safeguard customers' interests as well as citizens' rights. To this end, one-sided efforts may not cut it. An enabling framework is needed to better connect innovators with other actors (public authorities, research institutes, citizens etc.) and help them jointly deliver trustworthy innovations. The role of policy makers is paramount for shaping framework conditions that keep pace with technology trends, stimulate business growth in line with EU values, and address emerging gaps (e.g. in terms of resources, knowledge, and skills) with appropriate support measures.

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ABBREVIATIONS

AI	Artificial Intelligence
AR	Augmented Reality
B2B	Business-to-Business
BaaS	Blockchain-as-a-Service
CBDC	Central Bank Digital Currency
CLV	Customer Lifetime Value
CRM	Customer Relationship Management
CSA	Coordination and Support action
DeFi	Decentralized Finance
DLT	Distributed Ledger Technologies
EC	European Commission
ERP	Enterprise Resource Planning
EU	European Union
GDPR	General Data Protection Regulation
HR	Human Resources
ICT	Information and Communications Technology
IoT	Internet of Things
IP	Intellectual Property
IPR	Intellectual Property Rights
IT	Information Technology
LTV	Lifetime Value
MR	Mixed Reality
NFT	Non-Fungible Token
NGI	Next Generation Internet
P2P	Peer-to-Peer
PWAs	Progressive Web Apps
R&I	Research and Innovation
RIA	Research and Innovation action
ROI	Return on Investment

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SaaS	Software as a service (SaaS):
SMEs	Small and Medium Enterprises (SMEs)
VCs	Venture Capitals
VR	Virtual Reality
WAH	Work at Home
WFH	Work from Home
XaaS	Anything as a Service
XR	Extended Reality

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1 INTRODUCTION

This report, titled "**Future trends on NGI business models and related aspects**", has been elaborated within the framework of the **NGI TETRA** project which has received funding by the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 825147.

The overarching objective of this report is to **explore future trends** of NGI business models and related aspects that may drive the sustainability and viable commercialization of NGI innovations. In order to achieve this objective, we utilise the knowledge base produced during the initial phase of the project, and further enhance it by conducting a dedicated desk research focused on identifying and **analysing business models** that can support the viable commercialisation of NGI innovations, with a focus on the **trends expected to drive them in the future**. Then, in order to validate and further enrich our desk research results, we conduct interviews with relevant European NGI experts, gaining additional insight into NGI business models and their related current and future trends. Finally, we triangulate the results from the desk research and interviews with the initial knowledge base of NGI TETRA to draw meaningful **conclusions and implications** for NGI beneficiaries and stakeholders about the future of NGI business.

Along these lines, this report is structured as follows:

- **Chapter 1** provides background information on the context of the report and familiarises the reader with its aim and structure.
- **Chapter 2** describes the methodological approach followed in order to elaborate this report in line with its aim.
- **Chapter 3** introduces and maps the NGI ecosystem, identifying needs and challenges faced by innovators bringing NGI innovations to market.
- **Chapter 4** discusses current NGI business models and trends based on findings from our literature review and interviews.
- **Chapter 5** draws and presents our conclusions along with implications for NGI beneficiaries about the future of NGI business models.

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2 METHODOLOGICAL APPROACH

In order to elaborate the current report, we designed and applied a tailored methodological approach blending both primary and secondary research. In particular, we kick-started by **capitalising on the knowledge base produced during the initial phase of NGI TETRA** (Work Package 2). The theoretical and empirical insights that stemmed from D2.1 "Report on barriers and Challenges" as well as from D2.2 "TETRA's value proposition" were utilised and further enhanced by means of a dedicated desk research. Our focus this time was placed on **reviewing existing literature to map the NGI ecosystem and its needs**, while at the same time also **identifying and analysing business models** that can support the viable commercialisation of NGI innovations. The literature review was based on up-to-date input which was publicly available on trusted internet resources, such as general and trade press, directories, websites, articles, published reports, and trade associations output. The findings from our literature review were then **enriched with empirical insights** which had been extracted in the past by previous exchanges with relevant experts on our topics of focus.

In addition, **we re-launched the survey** on exploring the NGI beneficiaries' business support needs and interests with a view to exploring:

- the **factors hindering the market exploitation** of innovative products and solutions, especially in high-tech businesses and innovators, as well possible measures to address them.
- the **current status along with potential future plans** (both in terms of technical development and competencies as well as interests to exploit their research results) of NGI beneficiaries.

To this end, Q-PLAN with the support of other partners updated the **questionnaire** used during the first survey round. The updated questionnaire was uploaded on a dedicated online survey tool, making it easily accessible to NGI beneficiaries. Prior to the official launch of the survey, our team pilot-tested the questionnaire internally in order to identify and eliminate any technical or methodological problems that could compromise the validity of the responses.

In this second round of the survey all NGI beneficiaries that were still within their funding period (and therefore were not included in the first survey round that run in December 2019) were invited to participate and provide feedback leveraging the valuable help of their respective NGI Research and Innovations Actions (RIAs). With a view to reaching a sound response rate, the survey was also promoted during the activities of NGI TETRA (e.g. during the #2 Scale-Up TETRA Bootcamp). In result, we achieved a total **14 new responses** which were combined with the old ones to give us aggregated insights into the NGI business needs (overall the grand total over both survey rounds included **44 dully filled in questionnaires**).

Following up our survey with a view to furthering enriching our knowledge base, **we performed a series of 12 in-depth interviews with relevant experts**, gaining mostly qualitative feedback on NGI business models and their related future trends. To this end, we started by preparing a list with relevant European NGI experts. We continued by designing a tailored **interview questionnaire** to capture their insights and feedback, keeping in mind to complement the data

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collected via our desk research and survey. The questionnaire was designed with a **semi-structured approach**, so as to provide us with a flexible tool that allows interviewers to adjust its questions based on the information already retrieved, preventing interviewee fatigue. **Interview guidelines** were also prepared by Q-PLAN and shared with the interviewers of CE, SD and PEDAL in order to ensure a common and more comprehensive understanding of questions and objectives. Along the way, in compliance with applicable personal data protection regulations (including the General Data Protection Regulation of the EU), our team utilised an **Informed Consent form**. This form accompanied the interview questionnaire, providing information about the scope of the interview and inviting interviewees to give their explicit consent for participating.

Finally, insights from our interviews with NGI experts were **qualitatively analysed** alongside the findings from our dedicated desk research as well as the insights available from our initial knowledge base and the (aggregated) survey results. The analysis provided useful **conclusions and implications for NGI beneficiaries** as well as for any stakeholders interested in learning more about what the future of NGI business may hold in the context of the EU.

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3 THE NGI AND ITS BUSINESS NEEDS

3.1 NGI definition and ecosystem

The **Next Generation Internet (NGI)** is an initiative of the European Commission (EC) that aims to shape the development and evolution of the Internet into an **Internet of Humans**[3]. The initiative is based on the European Union´s (EU) **"Digital Agenda for Europe"** launched in 2010 with the aim of maximizing the growth potential of the digital economy, by promoting **digital skills and high-performance computing, digitizing industry and services, developing artificial intelligence, and modernizing public services.** The core principles of the NGI initiative were created based on an open consultation commissioned by the European Commission in 2016-2017[4] and a study commissioned in 2017-2018[5].

The NGI creates an **Internet that responds to people's fundamental needs**, including trust, security, and inclusion, while reflecting the values and the norms all citizens enjoy in Europe. The five pillars of the NGI are: **Democracy**, **Resilience**, **Sustainability**, **Trust,** and **Inclusion** (Figure 1) under which a wider a range of topics, such as raising the level of safeguards against hacking and cyber-attacks, giving better accessibility for persons with disabilities, allowing linguistic diversity and decentralizing data governance, are covered**.** The vision for the next 10 years is to shape the development of an **Internet that is trustworthy, open, and that contributes to a more sustainable and inclusive society.**

Moving closer towards this ambitious vision requires a **diverse palette of technological, legal, regulatory, economic, and social interventions** across the internet's power stack, and a **mobilization of Europe's ecosystem**. The internet is too complex and multifaceted to be treated as one single entity for the purposes of policy and funding interventions. That is why the NGI is an **overarching mission, with goals for each of the five respective pillars**, each of the pillars requiring the mobilization of different stakeholder communities and interventions across different layers of the stack[6].

FIGURE 1: NGI PILLARS

[3] *The NGI Initiative: An Internet of Humans*. Next Generation Internet. https://www.ngi.eu/about/.
[4] Overton, D. (2017). *NEXT GENERATION INTERNET INITIATIVE – CONSULTATION (Final Report)*. European Commission. https://tinyurl.com/2p8z38vp.
[5] European Commission. (2018). Next Generation Internet 2025. https://tinyurl.com/2p9xammc
[6] Bego, K., & Droemann, M. (2020). NGI Forward: A vision for the future Internet [Working Paper]. https://tinyurl.com/5n7mcft8

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In order to mobilize Europe´s ecosystem with a comprehensive approach, funding for the NGI was started in 2018 under the Horizon 2020 program **"Industrial Leadership – Information and Communication Technologies (ICT)"**. The aim of the program was to enable Europe to support, develop and exploit the opportunities for the benefits of its citizens, businesses, and scientific communities and the NGI initiative belonged under one of the six activity lines of ICT, targeting the challenge stated as: **"Future Internet: software, hardware, infrastructures, technologies and services"** [7].

3.1.1 NEXT GENERATION INTERNET PROJECTS

The NGI Initiative runs on two types of projects: **"Research and Innovation actions"** and **"Coordination and Support actions"**. The aim is to build a European ecosystem of researchers, innovators, and technology developers by selecting and providing financial support to the best projects submitted by third parties in a competitive manner.

Research and Innovation Actions (RIAs) focus on a specific field of research, supporting the objective of a human-centric Internet by funding several third parties contributing to the same field of research in parallel. Each of the selected third parties' projects pursue its own objectives, while the RIAs provide the program logic and vision, the necessary technical support, as well as coaching and mentoring[8]. Research and Innovation Actions Grants are cascading: 20% to select, monitor, mentor, train and build the community; 80% to fund individual projects from researchers, developers, hi-tech start-ups, or businesses[9].

Coordination and Support Actions (CSA) offer the support for the third parties and RIAs, creating a nurturing environment by providing networking opportunities, business mentoring, communication and marketing as well las researcher-in-residence opportunities, with a view to ensuring the best use of the outcomes created.

Overall, 10 RIAs and 5 CSAs were funded under the initiative by mid-2021.

[7] CORDIS | European Commission. Cordis.europa.eu. Retrieved from https://tinyurl.com/7f276v99
[8] CORDIS | European Commission. Cordis.europa.eu. Retrieved from https://tinyurl.com/2p94f9uw
[9] European Union. (2019). Next Generation Internet: The Internet of Humans [Brochure]. https://tinyurl.com/5dfkf5t2

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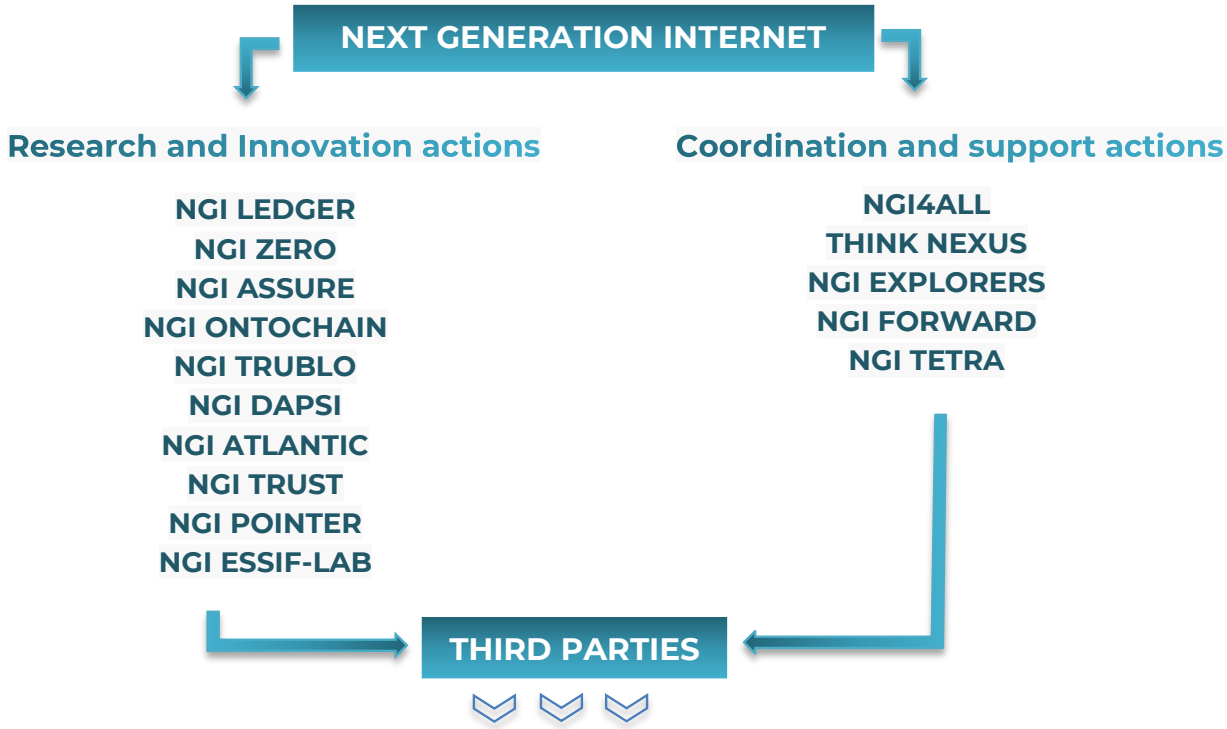
FIGURE 2: OVERVIEW OF THE NGI INITIATIVE



Through these projects, the NGI initiative funds innovators (NGI beneficiaries or third parties) that imagine and develop the Internet of Humans. Support is given to **research and innovation for alternative solutions from individual talents who will develop technologies in line with the NGI values and vision,** such as SMEs and start-ups. This gives them an opportunity to develop their innovative solutions with vital resources. Each project receives an **NGI grant, typically €50,000 – €200,000**, which can significantly shorten the research cycle and time to market[10]. The following is a list of NGI RIAs, revealing the background to their activities and the number of third parties funded in their field.

BLOCKCHAIN | NGI funds projects on blockchain, peer-to-peer technology and decentralized ledger technology through a Research and Innovation Action **NGI LEDGER**. Focus is on a variety of areas including health, economy, mobility, public services, energy and sustainability and open innovation.

34 third parties funded

SAFER SEARCH | NGI grants are awarded to projects for Internet search, peer-to-peer, distributed ledger, browser and routing through a Research and Innovation Action named **NGI ZERO DISCOVERY**.

143 third parties funded

[10] NGI: The people building the Internet of tomorrow. (2020). https://tinyurl.com/ywew2hn7

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OPEN-SOURCE PRIVACY | NGI grants are provided to open-source privacy projects through a Research and Innovation Action named **NGI ZERO PET**. It supports Privacy and Trust Enhancing Technologies to fix Internet weaknesses. Selected innovators devise new ways to manage passwords, encrypt email or improve Internet traffic protocols.

151 third parties funded

COMMERCIAL REALISATION OF PRIVACY INNOVATION | NGI grants are awarded to scalable privacy-related projects through a Research and Innovation Action named **NGI TRUST**. Projects are user centric, and invoke trust, privacy, data protection and harness self-sovereign identity

57 third parties funded

DATA PORTABILITY | The EU is a global leader on legislation on Data Protection for better transparency on citizens' data, as well as improved data compatibility and interoperability to facilitate switches between service providers. NGI's Data Portability and Services Incubator - **NGI DAPSI** - is helping to fund projects that help facilitate these standards.

26 third parties funded

SELF SOVERIGN IDENTITY | The NGI supports Self-sovereign Identity (SSI) through **NGI ESSIF-LAB**, which promises to empower European citizens with new means to manage privacy, to eliminate logins, and to enjoy much faster and safer electronic transactions via the internet as well as in real life.

50 third parties funded

ENGINEERING REUSABLE BUILDING BLOCKS | The NGI is supporting projects that design and engineer reusable building blocks for the Next Generation Internet through **NGI ASSURE**. This is a part of a complete, strong chain of assurances for all stakeholders regarding the source and integrity of identities, identifiers, data, cyber-physical systems, service components and processes.

49 third parties funded

BLOCKCHAIN-BASED KNOWLEDGE MANAGEMENT | The NGI provides funding to internet innovators for developing blockchain-based knowledge management solutions that address the challenge of secure and transparent knowledge management as well as service interoperability on the Internet through **NGI ONTOCHAIN**. It supports in the conceptualization, development, experimentation, and integration of new blockchain and Distributed Ledger Technologies (DLT) that aim to preserve the integrity and reliability of information and content.

30 third parties funded

FIGHTING MISINFORMATION ON SOCIAL MEDIA | The NGI provides funding to internet innovators who aim to advance the available solutions beyond the state of the art in trust and reputation models on blockchains by **NGI TRUBLO**. It supports the implementing of reputation-based mechanisms and finding different ways to achieve proof-of-presence and proof-of-location, thus fighting disinformation and distributed trust.

10 third parties funded

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ARCHITECTS TO CHANGE THE FABRIC OF THE INTERNET | Internet architecture is addressed through the NGI Program for Open Internet Renovation - **NGI POINTER** - for an efficient, scalable, secure, and resilient Internet.

36 third parties funded

EU-US COLLABORATION | Collaboration is supported through **NGI ATLANTIC**, which funds EU-based researchers and innovators to carry out NGI related experiments with US research teams.

20 third parties funded

3.1.2 OVERVIEW OF THE NGI ECOSYSTEM

The NGI ecosystem is a vibrant community of researchers, innovators, civil society participants as well as major private and public stakeholders who have joined forces around a common goal: to build an Internet of Humans[11]. **NGI innovators act as agents of change** as they create real solutions by developing technologies in line with the NGI's values and vision, thereby directly contributing to the development of the Next Generation Internet. Along these lines, in this section, an **overview of the community of NGI innovators** is provided.

The innovators funded by NGI projects by January 2022 were 595, consisting of different organisations such as SMEs, start-ups, individuals, and academic institutions. The activities of these 595 NGI innovators funded cover a wide and diverse mix of different technologies, within which RIAs and CSAs encourage third parties to engage in the use and development of protocols, software, and hardware. The main priority topics covered are: **distributed ledger and decentralised solutions, blockchain, routing, communication services and applications, cryptography, artificial intelligence, 5G and Internet of Things.** Projects cover a broad range of subjects from private search, instant messaging and remote working tools with data privacy over to health, energy, finance, knowledge management and responsible media platforms (Figure 3 overleaf).

[11] NGI Outreach Office. Next Generation Internet. Retrieved from https://tinyurl.com/4zpdxbvz

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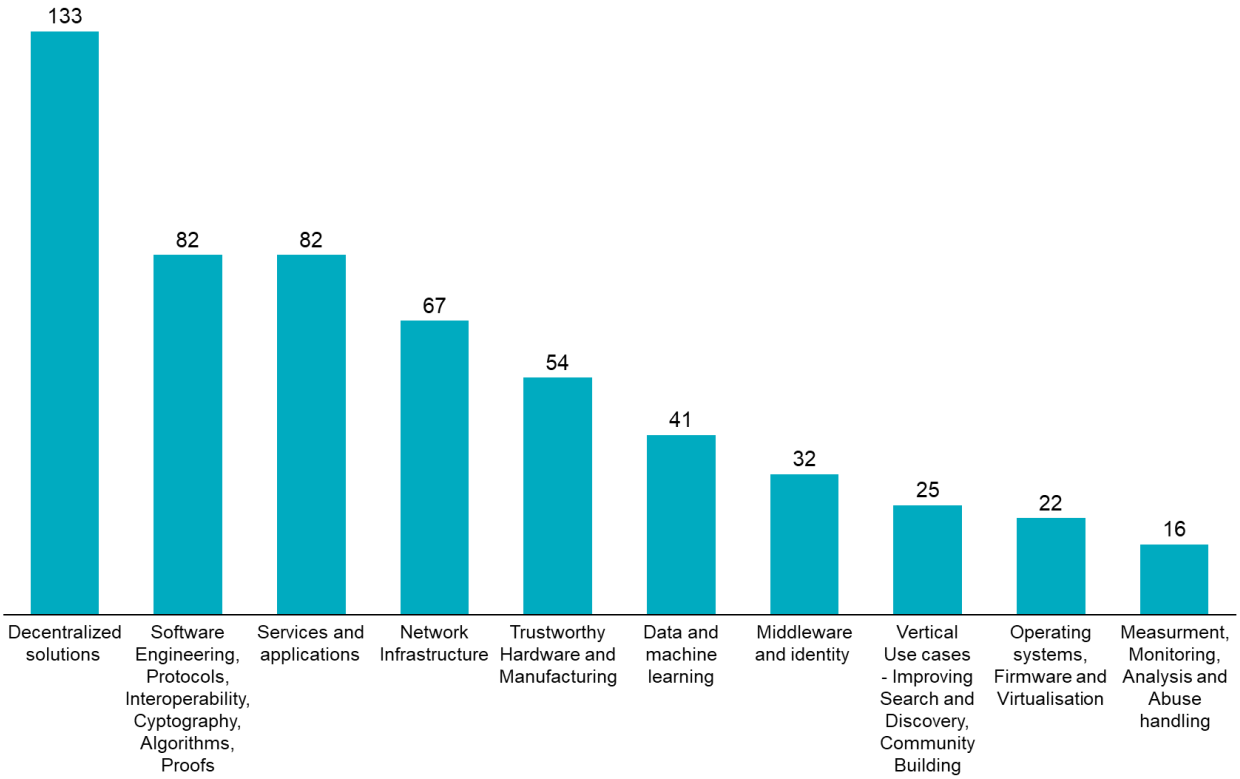
FIGURE 3: NGI INNOVATORS FOCUS AREAS BY JANUARY 2022



The types of organisations of funded Innovators[12] see a predominance of individuals, SMEs, and start-ups, followed by academic institutions and non-profit organisations, namely:

1. Individuals: **53%**
2. SMEs and start-ups: **29%**
3. Higher Education (e.g., university): **8%**
4. Other not-for-profit (NGO, foundations, associations, etc.): **7%**
5. Research organisations: **3%**
6. Other Public Sector (municipalities, regions, etc): 0% (2 organisations)
7. Other private organisation (large company, etc.): 0% (1 organisation)

3.2 NGI business needs

The NGI initiative supports innovators not only to develop NGI innovations, but also to effectively commercialise them through marketable products and services which can introduce meaningful benefits to our economy and society. Under this light, this section of the report identifies **business needs and challenges** within the NGI ecosystem and in particular amongst NGI beneficiaries seeking to introduce their NGI solutions to market. Successfully addressing those business needs and challenges can enhance the capitalisation of research results and may drive the sustainability and viable commercialization of NGI innovations.

[12] Information by mid-2021, based on 576 funded Innovators

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Along these lines, **a systematic approach** to addressing the needs and challenges that can serve as roadblocks to the commercialisation of a product, a service or a technology that contributes to the NGI, is imperative. The consortium of NGI TETRA explored and identified such needs and challenges of NGI beneficiaries (D2.2.) in order to develop tailored business support services that employ a systematic approach towards addressing commercialisation roadblocks.

Our findings, as documented in D2.2, indicate that NGI projects and businesses **need tailored support, in terms of advice, mentoring and training, to transform their results into marketable products and services.** The importance of providing developers, researchers, and innovators with skills in entrepreneurship and commercialisation is increasing, especially after considering the speed at which technological innovation takes place and market conditions change. Another factor that emphasises the need for building such skills amongst NGI innovators lies within their typical **preference to focus more on innovation and technology, rather than business**. In other words, it appears that innovators innovate to innovate by producing exceptional results which, however, **cannot be marketed without a business strategy and funding**. This argument is validated by the survey of NGI TETRA on business needs, according to which 39% of the sample indicated that they were at the idea stage without having received any funding. This is typically summarized in the literature as the **need for innovation management** calling for dedicated support to help beneficiaries effectively manage innovation, develop innovation processes and ultimately bring (new or existing) products and services to market successfully.

More specifically, the **fields of focus for innovation management support** could include: (i) developing a strong innovation culture and introducing techniques to breed innovative ideas with the power to drive growth strategies of the beneficiary; (ii) adapting a business model to exploit continuous innovation; (iii) setting project success criteria; (iv) applying project management principles and then evaluating return on investment (ROI); (v) establishing manufacturing readiness, ensuring market readiness (validating technology, identifying value propositions, understanding market potential, the product fit and building marketing strategies)[13]. Furthermore, according to a study conducted for the Innovation Radar, only 1 out of 3 innovative projects planned for market-launch have or will produce a market study, whereas only 27% of the projects are about to develop a business plan[14]. It appears that innovators may face increased difficulties **when it comes to creating an effective strategy for growth**, determining the future financial needs and attract investors and lenders.

Meanwhile, the **lack of adequate managerial skills** has been found to impede the commercialization and growth process as well. For example, it could lead to: (i) incorrect evaluation of the market situation (market potential of the product / service and market maturity); (ii) inaccurate assessment of the direct and indirect

[13] Innovate UK EDGE. Build your capacity for innovation to grow and scale. Retrieved from https://bit.ly/3tWU1SI

[14] De Prato, G., Nepelski, D. and Piroli, G. (2015). Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects. [online] EC, Joint Research Centre. Retrieved from https://bit.ly/35S2JCn

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external environment; (iii) biased estimation about the expected cashflows; (iv) poor business plans; and (v) limited knowledge on effective team management skills. With regard to other social factors, NGI innovators have brilliant ideas, yet they may face **difficulties to communicate them with the proper stakeholders** (partners, customers, investors, etc.) to turn them into business. This highlights the need for encouraging NGI beneficiaries to take part in competitions for innovators and attend more matchmaking events. Considering the above, these innovators might be able to better pitch their ideas and products/services and expand their network with potential collaborators and investors[15].

Along similar lines, **raising external finance** especially for the first stage of the innovation process, during idea generation, can be very difficult, since there is a high level of asymmetric information and no easy ways to align incentives. Knowledge and ideas are intangible, uncertainty is typically very high, and spill overs are thought to be stronger. More specifically, NGI innovators face several barriers that hamper technology diffusion, such as information asymmetries between innovators and financial providers, high costs of switching to new technologies, high entry costs (especially in areas with important network effects), and technological path dependencies, with some of them leading to market failures[16]. The results of an Innovation Radar study revealed that **41.9% of ICT innovators have limited access to financing** which is mandatory to exploit and commercialise their innovative product or service[17]. This is also verified by the aggregated NGI TETRA survey results on business needs of NGI beneficiaries, where 50% of the NGI projects did not receive any sort of funding from investors.

Depending on the stage of the innovation process **several forms of finance provision are available.** Business angels are one of the main sources of finance, typically in the form of equity or convertible loans. Early-stage venture capital funds, crowdfunding platforms, accelerators, and institutional investors and banks also play a role. Generally, there are alternative ways of funding considering the inherent characteristics of the entity, the type of innovation that is channelled to the market and the stage of a company's development[18]. Nevertheless, this is not enough because the barriers on accessing funding for NGI initiatives is still present and challenging for them. The main reason is that the asymmetry of information does not allow investors and financial institutions to adequately evaluate innovative ideas in market terms and the viability of the overall investment (e.g. whether there is sufficient ROI and market potential for success).

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[15] Reypens, C., van Blitterswijk, D., & Haley, C. (2019). Motivations to scale: How European entrepreneurs think about growth and finance. Retrieved from https://bit.ly/394PvU

[16] World Bank Group. Financing Business Innovation. A Review of External Sources of Funding for Innovative Businesses and Public Policies to Support Them. Retrieved from https://bit.ly/3GfeILT

[17] De Prato, G., Nepelski, D. and Piroli, G. (2015). Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects. [online] EC, Joint Research Centre. Retrieved from https://bit.ly/35S2JCn

[18] Reypens, C., van Blitterswijk, D., & Haley, C. (2019). Motivations to scale: How European entrepreneurs think about growth and finance. Retrieved from https://bit.ly/394PvU
Vasilescu L. (2014). Accessing Finance for innovative EU SMEs – Key Drivers and Challenges. Economic Review – Journal of Economics and Business, Vol. XII, Issue 2.

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Therefore, **improving the information flow** between innovators and funding providers can relieve the financing and evaluation challenges faced by these two groups. To perform that, there is a clear need for the innovators to be trained in order to **improve their ability to provide essential information** to the funding providers. This information could be related with information on the commercialisation know-how, the market potential, and the competitive environment. The underlying aspect that should be encouraged for NGI innovators is the introduction of business-related activities on top of technological ones. For that reason, services such as **business coaching and mentoring** can improve innovators' readiness[19].

In this context, **Intellectual Property Rights (IPR) can work as a safety net** for NGI beneficiaries when sharing sensitive information about their ideas. At the same time, IPR can also incentivize NGI innovators to keep pushing for new advances in the face of adversity and facilitate the free flow of information by sharing the protected know-how critical to the original, patented invention. In turn, this process leads to new innovations and improvements on existing ones [20]. For that reason, there is a business need for NGI innovators to learn more how to secure their IPR with regard to patents, trademarks, designs, copyrights, IP management in collaborative projects, IP in business and IP commercialisation.

In order to further substantiate all of the abovementioned insights, the NGI TETRA consortium **launched twice a survey** for exploring the NGI beneficiaries' business support needs and interests. The survey aimed at exploring the factors hindering the market exploitation of innovative products and solutions, especially by high-tech businesses and innovators, as well possible measures to address them.

Figure 4 (see overleaf) presents the aggregated results of the question about the interest of NGI beneficiaries in NGI TETRA Services. Most of the respondents (61%) expressed their interest about the NGI TETRA services for qualified introductions and matchmaking, 57% of them indicated the new markets, sales, and marketing model guidance to successfully pitch their products and services and 48% of them have chosen the access to equity funding. Only 16% claimed that they have interest in training on transversal competencies and soft skills. The above mentioned underline the needs of NGI beneficiaries for training in proper networking, in business fields (market penetration, sales, and marketing models) and how to access equity funding.

[19] Ibid
[20] U.S. Chamber of Commerce's Global Innovation Policy Center. Why is IP important? Retrieved from https://bit.ly/3r0VQM3

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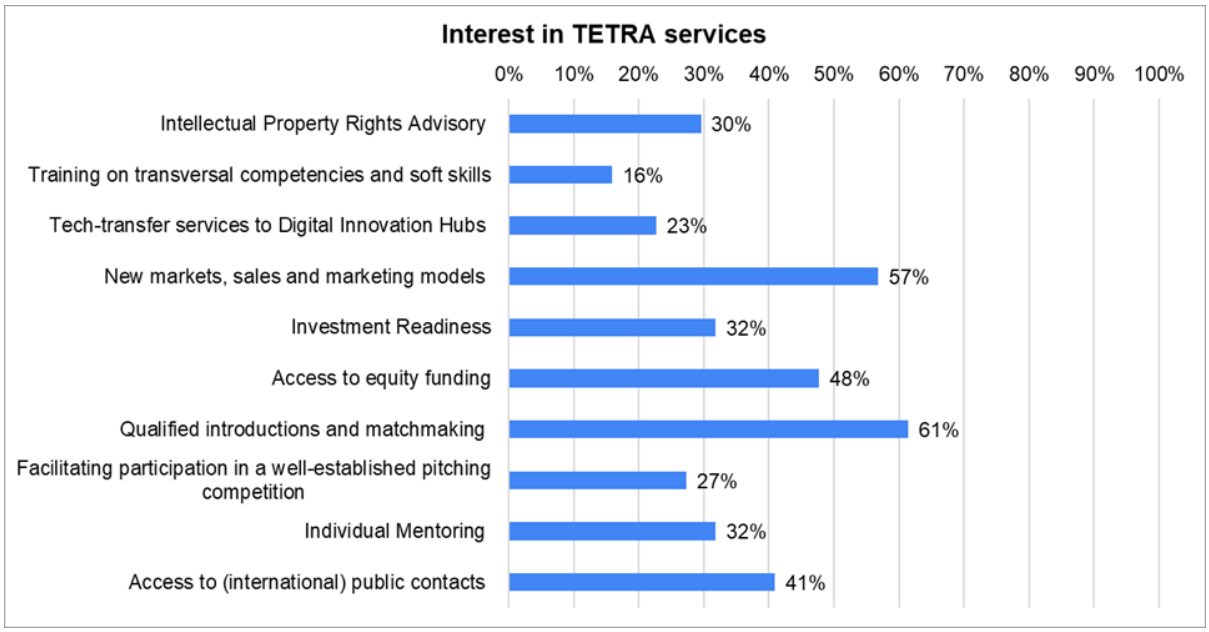
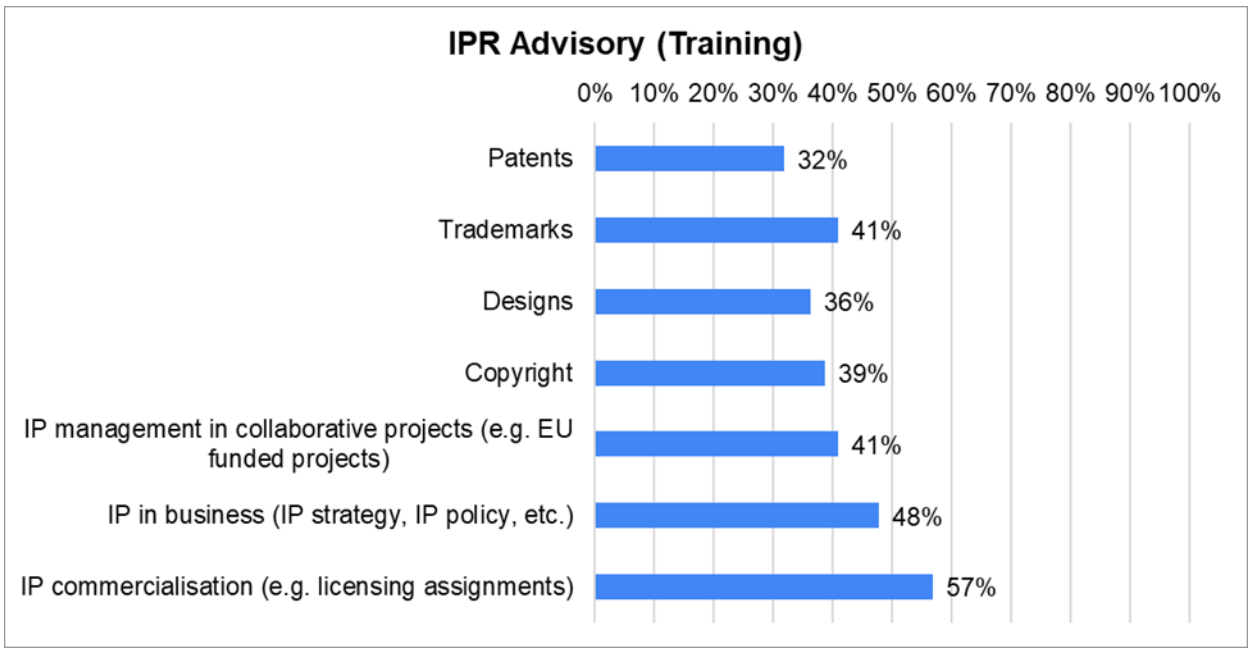
FIGURE 4: INTEREST IN TETRA SERVICES



Source: Aggregated TETRA Survey on NGI Needs, N=44

With regard to IPR Advisory, Figure 5 reveals that the respondents identified needs in the top three drivers of IP commercialisation (57%), IP in business (IP strategy, IP policy, etc.) (48%) and IP management in collaborative projects (EU funded projects) (41%). That implies that NGI beneficiaries are more familiar with patents, designs, and copyrights and need more targeted business-oriented training in IPR.

FIGURE 5: IPR ADVISORY- TRAINING



Source: Aggregated TETRA Survey on NGI Needs, N=44

The NGI TETRA consortium also investigated the NGI beneficiaries' gaps of knowledge related to investment topics. According to Figure 6, less than 20% of

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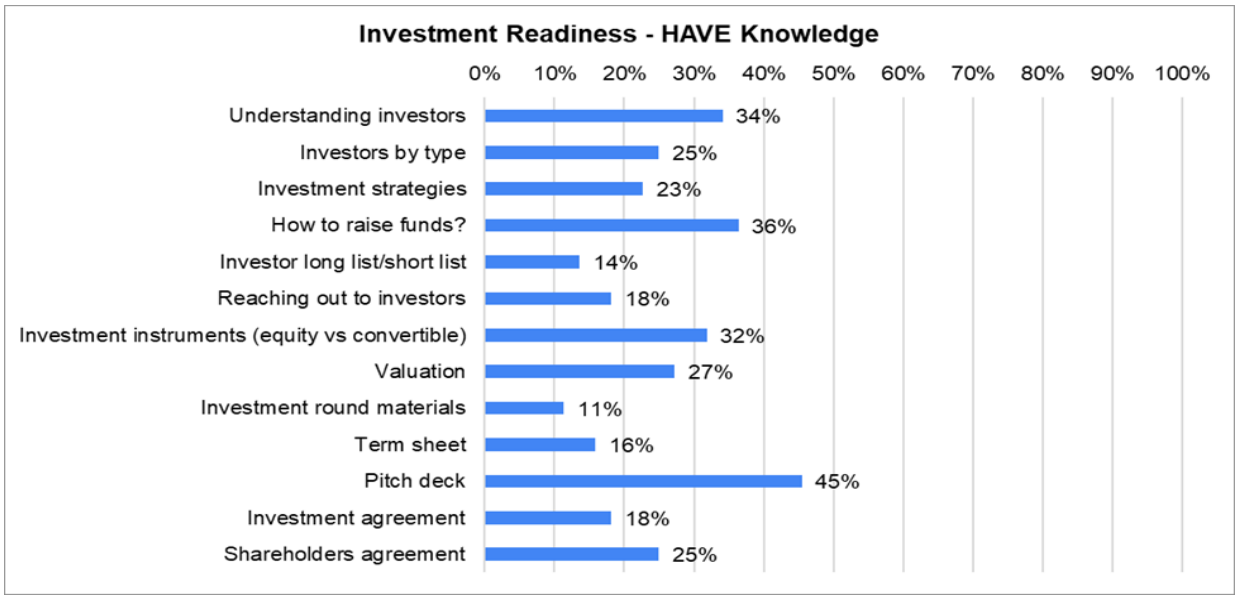
the survey takers have knowledge in investment round materials, investor long list/short list, reaching out to investors, term sheet and investment agreement.

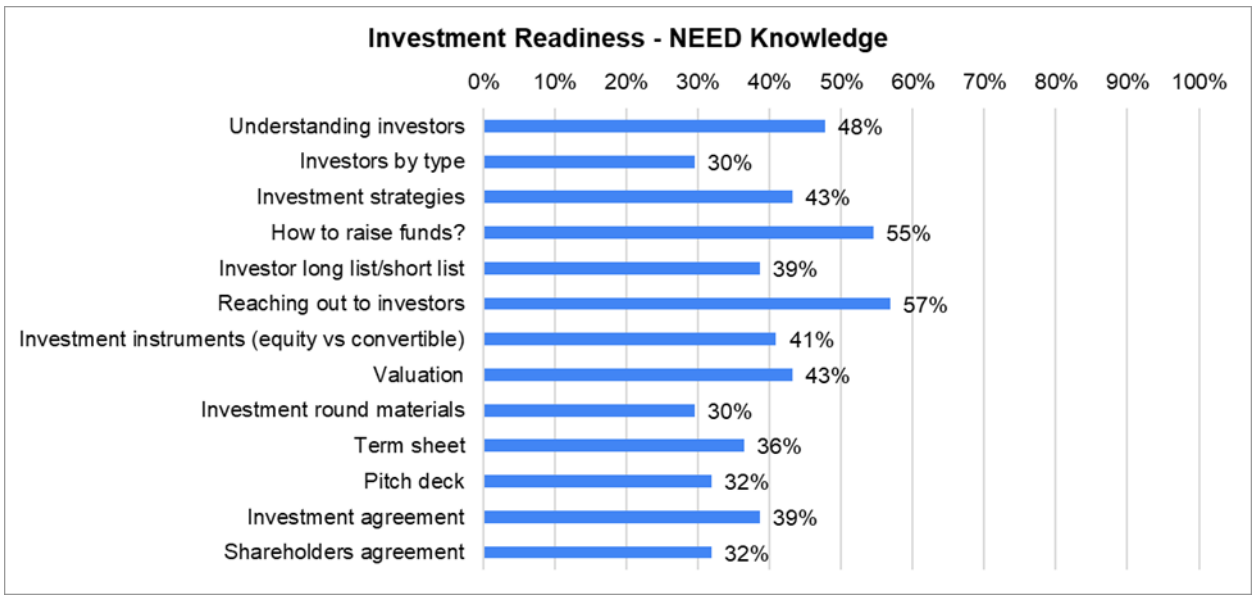
FIGURE 6: INVESTMENT READINESS - HAVE KNOWLEDGE



Source: Aggregated TETRA Survey on NGI Needs, N=44

Meanwhile, the top three drivers in terms of needs are how to reach out investors (57%), how to raise funds (55%) and understanding investors (48%).

FIGURE 7: INVESTMENT READINESS - NEED KNOWLEDGE



Source: Aggregated TETRA Survey on NGI Needs, N=44

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4 CURRENT NGI BUSINESS MODELS AND FUTURE TRENDS

4.1 Current NGI business models

4.1.1 FINDINGS OF THE LITERATURE REVIEW

In order to address their business needs, NGI innovators appear to employ an **astounding diversity of business models**. Along these lines, this section of the report provides an overview of the business models currently used within the NGI ecosystem as well as a more in-depth analysis of the most predominant ones according to the results stemming from the review of existing literature.

Overview of NGI business models

Over the course of our literature review, 80 types of business models were initially identified among the NGI. After a screening of these business model types based on the criteria of relevance to NGI values and the prospect of adoption among innovators, the 18 most prominent ones were selected for further analysis.

More specifically, the 18 business models selected were:

- **Consulting and experience selling, performance-based contracting-experience selling:** The value of a product or service is increased with the customer experience offered with it. This opens the door for higher customer demand and commensurate increase in prices charged. This means that the customer experience must be adapted accordingly, e.g., by attuning promotion or shop fittings. Performance-based contracting: A product's price is not based upon the physical value, but on the performance or valuable outcome it delivers in the form of a service. Performance based contractors are often strongly integrated into the value creation process of their customers. Special expertise and economies of scale result in lower production and maintenance costs of a product, which can be forwarded to the customer. Extreme variants of this model are represented by different operation schemes in which the product remains the property of the company and is operated by it[21].
- **Crowdfunding:** a product, project or entire start-up is financed by a crowd of investors who wish to support the underlying idea, typically via the internet. If the critical mass is achieved, the idea will be realized and investors receive special benefits, usually proportionate to the amount of money they provided. Crowdfunding can act as both - a starting monetary injection to fast-track new business or technology as well as an ongoing

[21] Business Model Pattern List | Business Model Navigator. Businessmodelnavigator.com. Retrieved from https://tinyurl.com/2p8t42h4

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subscription, which enables non-commercial solutions or projects to continue in their development by using the support of their users or fans.

- **Donations or pay what you want:** the buyer pays any desired amount for a given commodity, sometimes even zero. In some cases, a minimum floor price may be set, and/or a suggested price may be indicated as guidance for the buyer. The customer is allowed to influence the price, while the seller benefits from higher numbers of attracted customers, since individuals' willingness to pay is met. Based on the existence of social norms and morals, this is only rarely exploited, which makes it suitable to attract new customers.
- **Subscription:** the customer pays a regular fee, typically on a monthly or an annual basis, in order to gain access to a product or service. While customers mostly benefit from lower usage costs and general service availability, the company generates a steadier income stream.
- **Membership:** a membership model is a type of business model where individuals pay a recurring fee to access the value an organisation creates. It provides the design for different membership levels, revenue sources, marketing activities, events and conferences, and finances[22].
- **Software as a service (SaaS):** Software-as-a-Service (SaaS) is a software licensing model, which allows access to software on a subscription basis using external servers. SaaS allows each user to access programs via the Internet, instead of having to install the software on the user's computer.
- **Marketplaces:** online marketplaces connect buyers, sellers or service providers and service receivers on a proprietary and centralised platform. Oftentimes, the marketplace operator does not hold any type of inventory, but helps the buyers and sellers to facilitate a transaction, collect payments, ensure trust between parties, etc[23].
- **Peer-to-peer, sharing economy:** the sharing economy is an economic model defined as a peer-to-peer (P2P) based activity of acquiring, providing, or sharing access to goods and services that is often facilitated by a community-based online platform[24].
- **Fractional ownership:** fractional ownership describes the sharing of a certain asset class amongst a group of owners. Typically, the asset is capital intensive but only required on an occasional basis. While the customer benefits from the rights as an owner, the entire capital does not have to be provided alone.
- **Franchising:** the franchisor owns the brand name, products, and corporate identity, and these are licensed to independent franchisees who carry the risk of local operations. Revenue is generated as part of the franchisees'

[22] Ibele, T. (2018). The Complete Guide to Setting Up a Robust Membership Model. WildApricot Blog. Retrieved from https://tinyurl.com/2j39k5u5

[23] The marketplace business model. (2021). Retrieved from https://tinyurl.com/3wjxwwh4

[24] The Investopedia team. (2022). Sharing Economy Definition. Investopedia. Retrieved from https://tinyurl.com/4fdnvk4d

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revenue and orders. The franchisees benefit from the usage of well-known brands, know-how, and support.

- **White label:** a white label producer allows other companies to distribute its goods under their brands, so that it appears as if they are made by them. The same product or service is often sold by multiple marketers and under different brands. This way, various customer segments can be satisfied with the same product.
- **Freemium:** the basic version of an offering is given away for free in the hope of eventually persuading the customers to pay for the premium version. The free offering is able to attract the highest volume of customers possible for the company. The generally smaller volume of paying 'premium customers' generate the revenue, which also cross-finances the free offering.
- **Licensing:** efforts are focused on developing intellectual property that can be licensed to other manufacturers. This model, therefore, relies not on the realization and utilization of knowledge in the form of products, but attempts to transform these intangible goods into money. This allows a company to focus on research and development. It also allows the provision of knowledge, which would otherwise be left unused and potentially be valuable to third parties.
- **Revenue sharing:** revenue sharing refers to firms' practice of sharing revenues with their stakeholders, such as complementors, sales and other partners or even rivals. Thus, in this business model, advantageous properties are merged to create symbiotic effects in which additional profits are shared with partners participating in the extended value creation. One party is able to obtain a share of revenue from another that benefits from increased value for its customer base.
- **Open source with revenue sources:** Open-source technologies, in their essence, are well aligned with the goals of NGI. Although some might argue that it is more challenging to commercialise it, different paid add-ons or additional support features can make the open-source solution financially viable.
    - Paid (24/7) support- not charging for the software, but for the technical support;
    - Software as a Service (Open SaaS) Open-core model- not charging for the software but for the tooling and platform to consume the software as a service often via subscription;
    - Paid feature requests- charging only for the additional features;
    - Add-ons and open-source extensions for existing products- charging for the add-ons and open-source extensions for existing products;
    - Paid extra features, e. g. enhanced security, backup, support, etc.;
    - Paid certification- charging for the certification only;
    - Professional quality assurance- providing paid services for professional quality assurance;
    - Paid licensing for commercial use- licensing is the paid portion of the package.

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- **Various token-related business models including NFTs (value appreciation, scarcity, transaction, brokerage, and intermediation fees):** crypto tokens are coins that embed some intrinsic values somehow linked to the quality of the issuing entity's business model and to the ecosystem it generates[25].
- **Tokenization of assets:** asset tokenization is the process by which an issuer creates digital tokens on a distributed ledger or blockchain, which represent either digital or physical assets[26].
- **Stablecoins Business Models (Fiat-backed, Crypto-backed, Algorithmic):** Stablecoins are a type of cryptocurrency whose value is tied to an external asset to reduce volatility. Therefore, the value of a stable coin is linked to the much more stable value of flat currency – or government-issued currency such as dollars or euros. Thus, reducing the price volatility of the cryptocurrency to make it more appealing for transactions[27].

In order to support the presumption of business model relevance to SMEs building NGI solutions a short survey was conducted among NGI beneficiaries that were participating in the NGI TETRA project mentoring programme. The aim of the survey was to determine the most popular business models among NGI beneficiaries. Based on the results of the survey, we focused our field of research and were able to assess, through in-depth analysis, the difference among the business models and their suitability and relevance to cover NGI business needs. The results of our analysis are presented in the remainder of this section below.

Software as a Service (SaaS)

In the early days of Web 2.0, it might have been inconceivable that after massively spending on proprietary infrastructure one could deliver business software via a browser and become economically viable. Yet, today the large majority of B2B businesses run on Software-as-a-Service (SaaS) models[28]. SaaS is a software licensing model, which allows access to software on a subscription basis using external servers. SaaS allows each user to access programs via the Internet, instead of having to install the software on the user's computer[29].

Advantages

SaaS offers a variety of **advantages** over traditional software licensing models.

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[25] Tasca, P. (2019). Token-Based Business Models. springerprofessional.de. Retrieved from https://tinyurl.com/2p8ma8j6

[26] What is asset tokenization. (2021). Retrieved from https://tinyurl.com/2p9h6uxa

[27] What Are Stablecoins And Why Does It Matter For Business People. FourWeekMBA. Retrieved from https://tinyurl.com/2p9hcb43

[28] Mersch, M. Which New Business Models Will Be Unleashed By Web 3.0?. Medium. Retrieved from https://tinyurl.com/2p8a4ja6

[29] Grant, M. (2021). Software-as-a-Service (SaaS). Investopedia. Retrieved from https://tinyurl.com/2s4fknfs

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Cost | For businesses, subscription-based software licensing makes it simpler to understand and allocate costs for separate business units or departments. Plus, it can be easier to account for a steady expenditure rather than one, large cost every few years. For the software creators this business model can help onboard new clients, assure financial stability for a longer period of time and potentially increase the lifetime value of the customer. Publishers using the Software as a service model may also have multiple tiers of pricing, allowing businesses to pay less in exchange for access to fewer features of the application. This has created a lower buying threshold, giving smaller businesses access to software they might otherwise have been unable to afford.

Maintenance | Perhaps the best benefit of SaaS is the automatic access to patches and updates. A subscription-based model means the publisher will automatically update your licences as new versions are released. Your employees won't be using outdated tools and the business doesn't have to spring for a whole new application.

Mobility | Today's employees are looking for flexibility in their working lives — and workplace mobility plays a big part in that. As a result, businesses are embracing remote working policies. With no disc to be installed, SaaS-based applications can be used anywhere there's a network connection. It's helping the mobile workplace become more attainable.

Disadvantages

This model also comes with few **disadvantages**, and the most important ones are:

Security | Publishers aren't responsible for ensuring data security when using the SaaS model for their applications. Instead, it's the businesses responsibility to make sure there are appropriate security safeguards and protocols in place. The growing popularity of mobility in the workplace has created a somewhat unique challenge for IT departments as they struggle to secure mobile devices in remote locations. Employees will want and need to take workplace software applications on the go. And businesses need to accommodate this trend without opening themselves to malicious attacks.

Contractual obligations | Compliance is a huge concern for businesses partaking in SaaS offerings. SaaS contracts can be difficult to understand and the penalties for overusing licences are often steep. Companies found to be out of compliance by the publisher may end up having to pay a large, lump sum in order to get up to date quickly.

Loss of control | With the perpetual software sales model, applications were largely controlled by the business that used them. The SaaS model turns much of that control over to the publisher. Now, that can be a good thing. For instance, instead of having to gauge when to upgrade to the latest version of an application and going through the process of installing that new version, the publisher rolls out automatic updates. Still, it also means publishers keep a close eye on their

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clients' and they won't hesitate to audit a company they suspect is out of compliance with its contract. The process is largely controlled by the publisher and, if not prepared, businesses can find themselves struggling to navigate it[30].

Examples: *Google Docs, Dropbox, Salesforce, Slack, Amazon Web Services, HubSpot.*

Conclusions

SaaS possesses a lot of characteristics which could provide benefit to the NGI, especially due to its resilience, inclusiveness, and trustworthiness, which is complementary with NGI's main pillars. SaaS is following the NGI's sustainability pillar as well, by reducing costs for hardware acquisition and investing in digital devices. However, due to the remote nature of the model, a security risk may arise if endpoint security is not at the highest level, which is now vital in order to safeguard important data in an increasingly mobile world. Another point of consideration is the lack of control issue, having given much of the control to the publisher, as well as access to important information, which may not always be used in the user's interest. This could represent a breach to the NGI's democracy pillar, which stands for more democratic internet and decentralisation of it.

Subscription

Subscription business models are based on the idea of selling a product or service to receive monthly or yearly recurring subscription revenue. They focus on customer retention over customer acquisition. In essence, subscription business models focus on the way revenue is made so that a single customer pays multiple payments for prolonged access to a good or service instead of a large upfront one-time price. Now, the economy is trending toward more subscriptions instead of ownership for cars, software, entertainment, and shopping. This increases the lifetime value (LTV) of the customer.[31] The subscription economy has increased the intimacy between SaaS companies (or software vendors) and their customers. In the subscription economy, every company must better manage a direct, complex, responsive, multi-channel relationship with its customers. Customers are absolutely key in this relationship and rather than putting the focus of the business on the "product" or the "transaction," subscription economy companies live and die by their ability to focus on the customer. Now, the formula for growth is focused on monetizing long-term relationships rather than shipping products.[32]

Advantages

The model certainly has two-fold benefits: one for the businesses and the other for the customers. For the businesses, these include greater predictability of both

[30] Allender, E. (2019). The Pros and Cons of Software as a Service. Retrieved from https://tinyurl.com/2s3ujmra
[31] Tarver, E. (2021). Subscription Business Model. Investopedia. Retrieved from https://tinyurl.com/52sv5m4m
[32] Voices, V. (2017). The Not-So-New Promise Of The Subscription Economy. Forbes. Retrieved from https://tinyurl.com/ys6e8mzn

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income streams and product or service availability, lower acquisition and retention cost, and the possibility for better customer relationships. The model can be part of the promotional marketing activities or a specific sales promotion strategy of a business, as well as a source of its competitive advantage. For customers, the benefits include convenience, relatively cost savings, and a more open line of communication with the product or service provider.

Disadvantages

Of course, there are drawbacks as well. The model requires a business to allocate resources in implementing and maintaining a system needed to acquire and manage subscribers. Also, this system has technological requirements. Customers might also need to evaluate their purchasing decisions to ensure that they are making informed and valuable purchasing decisions. Fundamentally, both businesses and customers must ensure that the benefits outweigh the costs[33].

Examples: *Spotify, Amazon Prime, Apple Music, Kindle.*

Conclusions

Regarding NGI, there is a lot that the subscription business model could offer in order to satisfy NGI's business needs, from its resilience, sustainability as a digital asset, to inclusion. However, one of the biggest challenges of this model is, similar to the SaaS business model, its relation towards possessing users' information and its usage in maximising the profits, and not towards serving the public interest. That is because we now have access to so much more data. Everything from payment preferences to product choices, to sales histories, to browsing habits, to returns patterns is captured. And the software necessary to sift all that big data and refine it into actionable business intelligence is now available to everyone[34]. This could impact the process of democratisation of the internet.

Open source with revenue sources

In software engineering, the source code of a software product is not kept proprietary but is freely accessible for anyone. Generally, this could be applied to any technology details of any product. Others can contribute to the product, but also use it free as a sole user. Money is typically earned with services that are complementary to the product, such as consulting and support.[35]

Most common types of business models related to open-source software which we have identified are:

- Paid (24/7) support
- Software as a Service (Open SaaS) Open-core model

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[33] Pineda, M. (2021). Subscription Business Model: Advantages and Disadvantages - Profolus. Profolus. Retrieved from https://tinyurl.com/4j3zzh32

[34] Blair, T. The Subscription Economy May Be Revolutionary—But It's Not Without Risks. Articles.bplans.com. Retrieved from https://tinyurl.com/ysdpvn9c

[35] *Business Model Pattern List | Business Model Navigator*. Businessmodelnavigator.com. Retrieved from https://tinyurl.com/ysdpvn9c

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- Paid feature requests, add-ons, and open-source extensions for existing products
- Paid extra features, e. g. enhanced security, backup, support, etc.
- Paid certification
- Professional quality assurance
- Paid licensing for commercial use

Advantages:[36]

Free and/or cheaper than commercial products | Open-source software comes with a great advantage for the users since it can be installed for free. Furthermore, it can be used and deployed again and again on multiple machines without the need of tracking the licence compliance and terms of use. Open-source software helps companies save time and money by providing ready to use software as a whole. Open-source programs are developed with the intention to be available to anyone, even those who cannot afford commercial software. Furthermore, many of these programs are created to work with almost any type of platform, which helps extend hardware life and avoids the need to constantly replace them. For the companies, the advantage is in the complementary services which come with the software, given that it could lead to significant revenues, and still look to the consumers like they are not paying for the whole service.

Highly Reliable | Open-source software is usually developed by a group of talented and skilful experts or volunteers that simply love what they do for the community. Hence why most of the open-source software are high-quality programs. Also, any open-source software can be customised and tweaked by any user, which can help any company match the software with their business's needs.

Creating windows for monetizing | Some of the open-source business models, like the paid licensing model for example, creates a legal reason for users of open-source software to pay. It does this by providing an open-source licence with slightly onerous terms, such that anyone using the software in production is highly incentivized to strike a commercial deal with the vendor.[37]

Disadvantages

Highly unpredictable revenues and thinner margins | Services revenue is often highly unpredictable and requires significant scaling of headcount which can leave companies exposed when revenues shift. The margins with professional services are also much thinner than those for product-based companies.[38]

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[36] Khalaf, K. (2017). The Pros and Cons of Open Source Software. Medium. Retrieved from https://tinyurl.com/ywfy6yzj

[37] Kulkarni, A. 5 ways open source software companies make money. Timescale Blog. Retrieved from https://tinyurl.com/47a52vaa

[38] Ghory, I. (2020). The Secrets of Successful Open Source Business Models. Medium. Retrieved from https://tinyurl.com/3padasdw

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Unwillingness to pay for additional features and hosting | The economics of hosting are driven on the upside by willingness to pay, if the price is significantly higher than the cost of the underlying infrastructure then companies will choose to host for themselves, this is especially true for larger customers who already have sophisticated in-house DevOps teams.

Examples: *Wikipedia, Google (Android, Kubernetes), IBM (Open J9, Apache OpenWhisk, Open Blockchain), Apple Open-Source software (Swift, Webkit).*

Conclusions

The most common pattern for successful open source companies today is to have an open-core product combined with hosting and services as secondary and tertiary revenue streams[39]. The challenge with this model is in balancing the open-source value versus the proprietary: if an open-source company gives away too much, then it gives up the opportunity to make money; but if it gives away too little, then the open-source project effectively becomes "lame-ware" (and the project will likely fail to get broad adoption)[40]. In these regards comes the dilemma regarding the suitability of this business model for the NGI goals and values, i.e. what portion of the model will be committed to generating revenues and what portion will be dedicated to the principle of giving back to the community and democratising the internet, as one of the main NGI values.

Freemium

Freemium is a business model in which a company offers basic or limited features to users at no cost and then charges a premium for supplemental or advanced features. Freemium models are especially popular among software applications and internet-based businesses. This type of business model has the advantage of acquiring a large set of initial users, especially when there's no cost associated with trying out an app or a service. Ultimately, for the freemium model to work, companies must ensure their premium users can access more upgraded features, such as increased storage or customizations, and additional customer service. The freemium model tends to work well for internet-based businesses with small customer acquisition costs, but high lifetime value. It allows users to utilise basic features of a software, game, or service for free, then charges for "upgrades" to the basic package. It is a popular tactic for companies just starting out as they try to lure users to their software or service.[41]

Advantages

Brand awareness | When something is offered for free in the market, it grabs the people's attention towards the product, thereby creating brand awareness. It is

[39] Ghory, I. (2020). The Secrets of Successful Open Source Business Models. Medium. Retrieved from https://tinyurl.com/3padasdw
[40] Kulkarni, A., & Freedman, M. (2018). 5 ways open source software companies make money. Timescale Blog. Retrieved from https://tinyurl.com/3padasdw
[41] Segal, T. (2021). What Is Freemium?. Investopedia. Retrieved from https://tinyurl.com/2p9a38bt

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beneficial for first-time entrepreneurs and start-up companies entering with a new product.

Less Marketing effort | If the product or service enters a new market, only fewer marketing efforts are required to get free users. Without any flaws, it reaches more people when they recommend the product to others.

Viral Growth | With an extensive reach of your brand, it increases the number of free subscribers, the user base will be increased. This leads to the viral growth of your business.

Low Acquisition cost | Upselling your premium version to the free users would be a cakewalk for you. It decreases the customer acquisition cost.

Free beta testing | You can cut the extra burden to test your beta version. Trying out the different set of plans with the free users helps you to check the usability of the product and getting customer feedback helps to fine-tuning.

Disadvantages

Low Conversion Rate | The conversion from free user to paid user is quite hard for this freemium model. Unless you limit the features for the free users, you'll never make them buy a premium plan. Limited features of the free version will make the user feel exhausted and hang back, which reduces their interest in upgrading the premium plan.

Long time to profits | It will take a long time to convert the free users, which delays making a profit. Supporting the free user would increase the operational cost. It is not good to make maximum profit out of it.

High churn rates | The churn rate is high in the freemium model, as the subscriber will discontinue their subscription in a short time after purchase[42].

Examples: *Dropbox, YouTube, Spotify.*

Conclusions

One of the biggest advantages of the Freemium model is the opportunity for collecting data from a large number of users, which if not used wisely, could contribute to a loss of customers' trust. The conversion from free to paid users is a demanding and lengthy process, which usually results in a low conversion rate. This could further lead to increase in overhead, negative product positioning and finally lead to overall failure, which makes it unsustainable and not resilient. Therefore, this model has significant risks associated with it which should be considered and well analysed.

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[42] YT Team. (2021). Freemium Business Model - Explained With Pros And Cons | Young Thrives. Young Thrives. Retrieved from https://tinyurl.com/2p93a2wb

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Token-related business models including NFTs

The forthcoming wave of Web 3.0 goes far beyond the initial use case of cryptocurrencies. Through the richness of interactions now possible and the global scope of counter-parties available, Web 3.0 will cryptographically connect data from individuals, corporations, and machines, with efficient machine learning algorithms, leading to the rise of fundamentally new markets and associated business models[43]:

- **Payment tokens:** with The Rise of the Token Sale, a new wave of projects in the blockchain space based their business models on payment tokens within networks: often creating two sided marketplaces, and enforcing the use of a native token for any payments made. The assumptions are that as the network's economy would grow, the demand for the limited native payment token would increase, leading to an increase in value of the token.
- **Burn tokens:** revenue generating communities, companies and projects with a token might not always be able to pass the profits on to the token holders in a direct manner. A model that garnered a lot of interest as one of the characteristics of the Binance (BNB) and MakerDAO (MKR) tokens was the idea of buybacks / token burns. As revenues flow into the project, native tokens are bought back from the public market and burned, resulting in a decrease of the supply of tokens, which should lead to an increase in price.
- **Work tokens:** one of the business models for crypto networks that we are seeing 'hold water' is the work token: a model that focuses exclusively on the revenue generating supply side of a network to reduce friction for users. A work token model operates similarly to classic taxi medallions, as it requires service providers to stake / bond a certain number of native tokens in exchange for the right to provide profitable work to the network. One of the most powerful aspects of the work token model is the ability to incentivise actors with both carrot (rewards for the work) and stick (stake that can be slashed). Such tokens should be valued based on the future expected cash flows attributable to all the service providers in the network, which can be modelled out based on assumptions on pricing and usage.
- **Dual token model:** where one asset absorbs the volatile up- and down-side of usage and the other asset is kept stable for optimal transacting.
- **Governance tokens:** which provide the ability to influence parameters such as fees and development prioritisation and can be valued from the perspective of an insurance against a fork.
- **Tokenised securities as digital representations of existing assets** (shares, commodities, invoices, or real estate) which are valued based on the underlying asset with a potential premium for divisibility and borderless liquidity.
- **Tech 4 Tokens:** as proposed by the Starkware team that wish to provide their technology as an investment in exchange for tokens, effectively building a treasury of all the projects they work with.

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[43] Mersch, M. (2019). Which New Business Models Will Be Unleashed By Web 3.0?. Medium. Retrieved from https://tinyurl.com/2p93a2wb

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- **Personal Tokens:** personal tokens are fixed-supply and -cost ERC20 tokens that derive their value from the performance of a human being. They are commonly used to tokenize either individual service offerings or a fixed-price hourly service:
    - Equity based: In this model people are obligated to use a percent of their pre-tax or post-tax revenue to buyback issued tokens. It's similar to Income Share Agreements.
    - Debt based: It's possible to sell hours of work upfront for further redeeming. Issued tokens represent debt redeemable for work directly[44].
- **NFTs - Unique cryptographic tokens** that exist on a blockchain and cannot be replicated. NFTs can be used to represent real-world items like artwork and real-estate. "Tokenizing" these real-world tangible assets allows them to be bought, sold, and traded more efficiently while reducing the probability of fraud. NFTs can also be used to represent individuals' identities, property rights and more[45].

Examples: *CryptoKitties, OpenSea NFT marketplace.*

Advantages

The opinions regarding Token-related business models including NFTs vary from one extreme to the other. As Max Mersch has noted, "w*ith this wealth of new business models arising and being explored (such as Token-related business models including NFTs), it becomes clear that while there is still room for traditional venture capital, the role of the investor and of capital itself is evolving. The capital itself morphs into a native asset within the network which has a specific role to fulfil. From passive network participation to bootstrap networks post financial investment, to direct injections of subjective work into the networks, investors will have to reposition themselves for this new organisational mode driven by trust minimised decentralised networks. We are not ignoring the fact that Web 3.0 will have to go on an equally arduous journey of iterations (as Web 1.0 and Web 2.0), but once we find adequate business models, they will be incredibly powerful: in trust minimised settings, both individuals and enterprises will be enabled to interact on a whole new scale without relying on rent-seeking intermediaries.*"[46]

Disadvantages

On the other hand, there is also a scepticism regarding the relevance of the Web 3.0 agenda, including token related business models, according to Francesca Bria:

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[44] GitHub - FEMBusinessModelsRing/web3_revenue_primitives. GitHub. (2019). Retrieved from https://tinyurl.com/ypp6a797
[45] Sharma, R. (2021). Non-Fungible Token (NFT). Investopedia. Retrieved from https://tinyurl.com/yckzacem
[46] Mersch, M. (2019). *Which New Business Models Will Be Unleashed By Web 3.0?*. Medium. Retrieved from https://tinyurl.com/yckzacem

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"Tokenisation, for me, is the latest manifestation of what we could call the super-financialization of everything, enabled by the digitisation of physical processes and objects. Now one can attach IP rights to everything; make smart contracts out of everything; enable transactions in everything. We fought that logic early on, with Decode, when people started making arguments about data being an asset class, something that accrues to individuals, to be bought and sold. We always argued that one could also have a much more social and public take on data and specify collective access and ownership rights; data doesn't have to be treated as something proprietary, but as something that can create public value and redistribute wealth and rewards".

Conclusions

Can blockchain and crypto be of some help here? Maybe, but one would need to change the entire technological system. One would need to say that, instead of using blockchains to create smart contracts that enforce property rights, we want blockchains that enforce the "right to informational self-determination" or "the right to knowledge". Or even the right to inspect the algorithms in order to assess their impact. For example, this is very relevant today when it comes to collective bargaining and platform workers' rights in the gig economy. This would require transforming quite a lot of jurisprudence and reining in our notion of the public good and then also somehow fitting it onto the blockchain."[47]

Results and findings

When speaking about the various types of currently used business models and their relevance for the values around NGI, the main question to consider is the **balance between giving back to the community and commercialisation**. If this is achieved, then these different types of business models could give a great contribution to the whole idea of NGI, firstly through their commitment to shared knowledge and **availability of services without any barriers**, which is in line with the inclusion pillar of the NGI (this mostly refers to open source with revenue sources, as well as SaaS, subscription and token-related business models including NFTs). Furthermore, having in mind our rapidly changing environment, these business models have proved their worth by constantly adapting and building their **resilience**, as well as their **trustworthiness** among consumers (mostly refers to SaaS, Freemium and Open source with revenue sources).

Another benefit in this direction is the **sustainability commitment** of the business models, which is in line with the sustainability pillar of NGI (especially SaaS, Subscription and Open source with revenue sources models), through providing reduced costs for hardware acquisition and investing in digital devices. However, the **main issue is the possession and control over users' data**. All of the business models have access to enormous amounts of important information, which may not always be used in the users' interest. Artificial intelligence helps to extract meaning from this data and to embed autonomy and intelligence into networks, connected objects and services. Still, there is an **erosion of trust** on the

[47] Francesca Bria on Decentralisation, Sovereignty, and Web3. The Crypto Syllabus. Retrieved from https://tinyurl.com/2p9fkfp6

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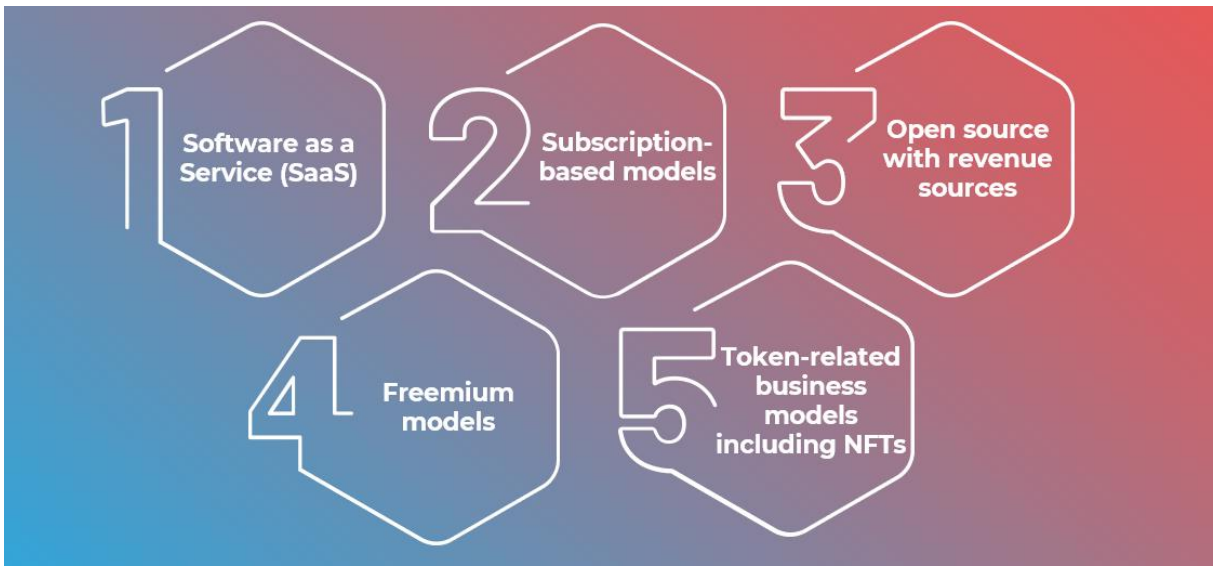
internet following revelations about the exploitation of personal data, large-scale cybersecurity and data breaches, and growing awareness of online disinformation.[48] This could represent a breach in the NGI's democracy pillar, standing for more democratic and decentralised internet. Which leads back to the beginning, i.e., will companies use this data for maximising profits, or will they be able to see and comply with the values NGI represents and stand with it, thus **giving citizens a real voice in the development of new NGI innovations**, which consequently serve the public interest and builds trust and social cohesion.

4.1.2 FINDINGS OF THE INTERVIEWS

The predominant NGI business models revealed by the survey of NGI beneficiaries were further discussed in a series of interviews with NGI experts across Europe, in order to enrich our literature analysis with fresh meaningful insights. Overall, the results of the interviews appear to align with the findings of the literature review, validating that, at the moment, amongst the most commonly used business models for initiatives seeking to develop and deliver NGI solutions are: (i) Software as a Service (SaaS); (ii) Open source with revenue sources; (iii) Subscription; (iv) Freemium; and (iv) Token-related business models including NFTs (Figure 8).

FIGURE 8: OVERVIEW OF PREDOMINANT NGI BUSINESS MODELS



Along these lines, the sub-sections that follow provide a concise synthesis of insights into these key business models currently employed for driving NGI solutions to market as well as cross-cutting insights unearthed via the interviews.

[48] Next Generation Internet, the Internet of Humans. (2019). [Brochure] (p. 2). https://ngi.eu/wp-content/uploads/sites/48/2019/09/NGI-Brochure_A5_HR_FinalPrinted.pdf.

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Software as a Service (SaaS)

The Software as a Service (SaaS) business model was widely acknowledged as a **contemporary and commercially viable business model** for NGI solutions amongst the vast majority of the interviewees. Delivering a series of benefits to potential customers (e.g. low requirements in terms of infrastructure and processing power, reduced maintenance costs, increased mobility), SaaS models can help businesses **meet expectations and requirements of a broader market**. At the same time, however, many interviewees also highlighted that this business model comes with its own set of risks which will need to be addressed if its alignment with the NGI pillars is to be safeguarded. The deployment of NGI solutions as a service needs to be accompanied with the capacity building required for users / customers to properly manage the service(s), with a view to minimizing the risk (and impact) of security breaches and data leaks, while also **safeguarding the digital rights of European citizens** (e.g. under the General Data Protection Regulation). Last but not least, NGI advances will need to be accompanied by standardization efforts in order to prevent the development of a "monoculture" created by SaaS solutions and business models deployed by key vendors that may limit competition and innovation in the field of NGI.

Open source with revenue sources

The interviews confirmed that the delivery of open-source solutions free of charge, while monetizing hosting and other services to create and capture value from customers, is **amongst the most frequently employed business models** amongst NGI businesses. Still, albeit most interviewees agreed on the great market appeal of the model as well as on its relative alignment with NGI pillars, their **opinions regarding its viability were mixed**. Some interviewees considered the open source with revenue sources approach as a viable model for creating a successful company, whereas others characterized it as rather challenging and sometimes unsustainable (from a commercial point of view). These divergent opinions may be indicative of how crucially important is for innovators to strike a **proper balance between open-source and proprietary value** in order to build a tailored blend of revenue streams in a sustainable manner that is also aligned with the values of the NGI. Along these lines, another key point (and opportunity) brought to light via the interviews pertains to privacy. As user generated content grows and advanced technologies applied at larger scales (e.g. IoT applications at city scale) generate even greater amounts of data, open-source models will need to find appropriately scalable solutions for addressing privacy concerns.

Subscription

Subscription-based business models found many proponents amongst the NGI experts who participated in our interviews. Many of the interviewees acknowledged that this business model is **quite preferable and used in practice** by NGI businesses at the moment, while also being especially suitable for mobile applications (e.g. box software with little personalization). The findings of the interviews also attested to the **great compatibility** of this particular business model **with the models of SaaS and open-source with revenue sources**. Indeed, based on the insights provided by the interviewees, it appears that it is not rare for subscription-based models to fall under the two aforementioned business model categories (with different variations). For instance, many NGI businesses seeking to create revenue streams from their open-source solutions opt to offer a

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subscription-based service in order to deliver and appropriate additional value from their customers (cloud hosting, consultancy, training, etc.). This may even include subscriptions in voluntary contributions (such as the case of Patreon). In this respect, interviewees highlighted that **business models (need and tend to) evolve** as a company develops its solution from an idea over to a minimum viable product and may pivot and/or address different markets (segments) on the way.

Freemium

The findings from the interviews indicate that freemium models, albeit popular amongst NGI businesses, are **not as well-received by the interviewees**. It seems that businesses adopting such business models tend to keep interesting and valuable features of their solution behind a **"paywall"**. This approach may initially attract customers and generate revenues for a business but in the end, it **may backfire**, splitting its potential customers in two groups: (i) a group of free users that do not directly create revenues; and (ii) a group that alternates between free and premium use. Most of the interviewees suggested that models with a more clear-cut distinction between free and paid features (e.g. SaaS or subscription-based) are more straightforward for customers and thus, may provide the basis for more targeted business strategies. Nevertheless, some interviewees also highlighted that **businesses may be driven towards freemium** business models, especially when private investors (e.g. VCs) are involved. This is often due to limited understanding of the prospects (and risks) of open-source business models and may lead to certain users being excluded from valuable parts of NGI solutions, features or services (e.g. updates, patches, early access), or even to companies creating windows for weaponized vulnerabilities (e.g. reverse engineering of early access releases). Overall, the insights we collected suggest that freemium may not be as aligned with the NGI compared to other models.

Token-related business models including NFTs

Business models based on tokens (including NFTs) were found quite relevant for NGI businesses by the majority of the interviewees. The decentralized and trustworthy nature of blockchain tokens can bring **great promise for applications aligned with the NGI pillars** along with opportunities for monetization. With that in mind, it may come as no surprise that, albeit blockchain tokens are still at an early stage, many businesses are trying to incorporate them into their business model and their use is expected to grow in the future. Nevertheless, many interviewees also highlighted that token-related business models **may currently be "overhyped"** amongst the NGI community, with applications providing relatively limited value and the market being distorted. Moreover, according to the interviewees, many may be looking to invest in such business models yet not as many appear to be equipped with the knowledge to develop and deliver applications that effectively meet market expectations in line with industrial and societal or requirements (e.g. in terms of security). It seems there is **still room for these business models to mature** and be used more extensively by NGI businesses in the future as well as for them to **provide more real-world value** (when compared to contemporary applications).

Cross-cutting insights into selecting suitable models for NGI business

Based on the popular opinion of the interviewed experts, each of the discussed business model archetypes can be suitable and thus, serve the needs of a NGI

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business. Still, **businesses need to be strategic when selecting their model**. The suitability of each model archetype depends on the target customer of the business as well as the solution offered (product, service or blend). For instance, SaaS may be more suitable for business clients, whereas consumers may be better served by subscription or freemium business models. Still, the consensus amongst the interviewees indicates that adopting a specific business model is **clearly not a one-dimensional decision**. The individual characteristics and needs of NGI businesses that are structurally different with each other as well as the particular needs of their target customers (be they consumers, businesses or other public / private organizations) should be carefully considered as well. Along these lines, many interviewees highlighted the vital importance of adopting a **customer-centric approach** to doing business with NGI solutions. This approach has the potential to help businesses not only to understand what is valued by their (prospective) customers, but also what customers are willing to pay for this value, ultimately allowing them to select an appropriate business model. In doing so, they can **align their value propositions towards meeting real world demand**, while also keeping in mind the values of NGI and their own interests.

4.2 NGI business trends

4.2.1 FINDINGS OF THE LITERATURE REVIEW

In parallel to identifying the business needs and challenges of the NGI ecosystem, the literature review we conducted for the needs of this report also focused on revealing **key trends expected to shape the future of NGI business**. In this respect, our findings suggest that a wide diverse array of trends is re-shaping the landscape of NGI business models. This section of the report provides an overview of these trends which appear to influence the future directions of the NGI and its ecosystem, including: (i) advances in the Internet of Things; (ii) trends propelling digital applications in business along with NGI innovation; (iii) growing small business trends offering opportunities for NGI innovators; (iv) as well as current and future trends influencing the NGI business model landscape.

Advances in the Internet of Things expected to transform the NGI

Our literature review indicates that advances in various fields of the Internet of Things (IoT) have a key role to play in the future of NGI business. In this context, the challenge for the NGI[49] and its link to IoT[50], is to design and build enabling technologies which enable humans and machines to seamlessly cooperate, while at the same time making data and components easy to use as well as profitable, all in an open and democratic way to every single user.

Along these lines, the **drivers expected to transform the NGI through IoT advances** can be divided into 4 categories as follows:

[49] Serrano, M. (2017). Building the future internet through FIRE.
[50] Vermesan, O., & Bacquest, J. (2018). Next Generation Internet of Things (p. 9). River Publisher.

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Intelligent Spaces | enabling computers to take part in activities in which they were never previously involved and facilitate the interaction of people with computers more naturally, i.e., through gesture, voice, movement, context, etc. Internet of Things (IoT) enriches environments in which ICTs, sensor and actuator systems become embedded into physical objects, infrastructures, the surroundings in which we live and other application areas (e.g., smart cities, industrial/manufacturing plants, homes, and buildings, automotive, agri-food, healthcare and entertainment, marine economy, etc.).

Autonomous Cooperative Machines | intelligent self-driven machines (robots) that are able to sense their surrounding environment, reason intelligently about it, and take actions to perform tasks in cooperation with humans and other machines in a wide variety of situations on land, sea, and air.

Collective User Experience | human-centric technologies supporting enhanced user experience, participatory action (e.g., crowd sourcing), interaction (e.g., wearables, devices, presentation devices), and broader trends relevant to how socio-economic values (e.g., trust, privacy, agency, etc.) are identified, propagated, and managed.

Key Networking Technologies | physical and software-defined infrastructures that combine communication networks (wireless, wired, visible light, etc.), computing and storage (cloud, fog, etc.) and technologies in support of different models of distributed computing underpinning applications in media, IoT, big data, commerce, and business operations.

Following the opinions[51] of other IoT experts show, that the IoT revolution makes it possible to collect real-time data on the preferences and activities of consumers and set these in a geographical and temporal context. The rapid development of IoT is illustrated by the fact that 90% of the world's data was generated during the last two years, and that the pace is still exponentially increasing towards an amount of data that was 40 times the size of 2017 in 2020. This is fuelled by appliances, vehicles and smartphones that are rapidly becoming data-gathering devices. The impact of data is rapid and is closely related to the development of low-cost sensors and network technologies such as Wi-Fi, Bluetooth, and the fifth generation of mobile networks (5G) that make it possible to both collect and transfer ever larger amounts of information. Improved cloud storage and computing solutions allow for cost-efficient and fast computing, in addition to insights gathered through AI algorithms.

Meanwhile, strengthening human–machine interaction, collaboration and cooperation using hyper autonomous IoT technologies and applications provides new opportunities for economic development and the digitisation of industries in the new digital age, extending the wave of continuous innovation and disruption of IoT business models[52]. The economic and societal potential of IoT[53] is

[51] Donner, H., & Steep, M. (2021). Monetizing the IoT Revolution. In: Sustainability 2021. Mdpi.com. Retrieved from https://tinyurl.com/y4d8r3w5

[52] Vermesan, O., & Bacquet, J. (2020). Internet of things - the call of the edge. River Publishers.

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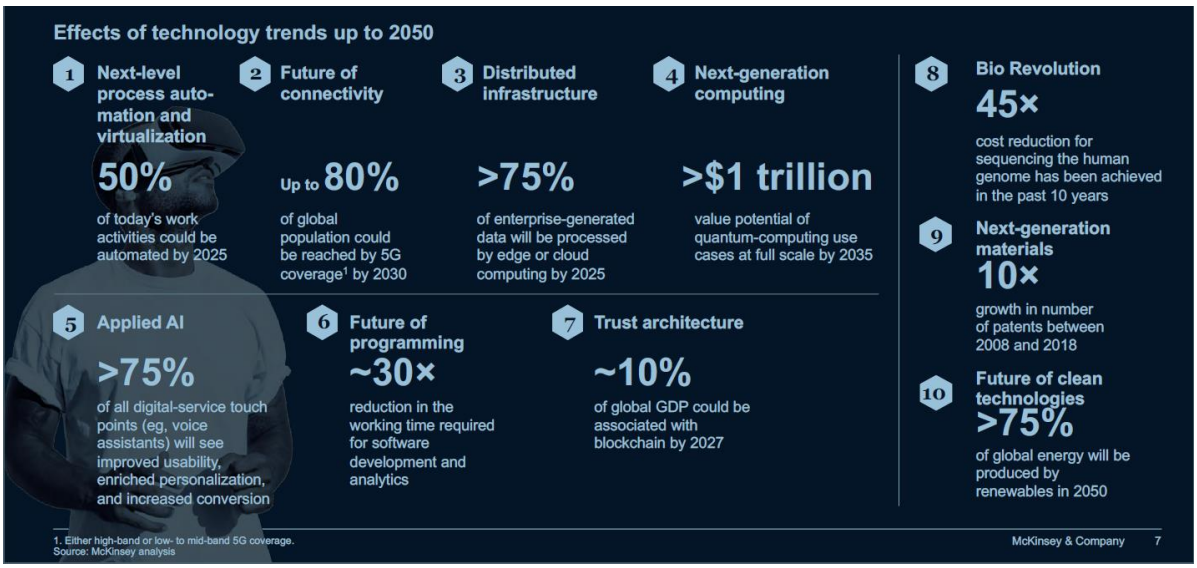
extraordinary: better use of natural resources through smart farming, better human health through devices linked to remote medicine and independent living, lower carbon emissions from autonomous driving and smart logistics, fewer accidents thanks to connected driving, smart cities through smart use of massive data generated from a multitude of new sensors in a city, etc.

At the same time, the currently preferred human interaction through apps and browsers and the increasing use of data is impacted by new trends and emerging technologies such as edge computing, messaging platforms, virtual assistant and robots that will integrate with data, things and algorithms at the edge leading to the post-app era to become human-centric. In the manufacturing industry, IoT[54] provides real-time feedback from operations of the manufacturing plant and gives a chance to make a move promptly when the arrangement is veering off from reality. It helps the decision makers to infer actions and enhance the production efficiency and visibility of the production line information.

Trends propelling digital applications in business along with NGI innovation

Besides technological advances in the IoT domain, a recent McKinsey[55] analysis identified **several additional technology trends** up to 2050. The authors have summarized them in 10 points which we can see on the next figure:

FIGURE 9: EFFECTS OF TECHNOLOGY TRENDS UP TO 2050



Source: McKinsey & company (2021)[56]

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[53] Bajic, E. (2018). Trends and opportunities for IoT future developments by means of Monetized Servitization of IoT Devices for new Business Models and new Applications in a global and seamless communication continuum. Retrieved from https://tinyurl.com/3seetran

[54] Malli, S. (2018). Real Time Big Data Analytics to Derive Actionable Intelligence in Enterprise Applications. in: Internet of Things and Big Data Analytics Toward Next-Generation Intelligence (1st ed., p. 108). Springer.

[55] Corbo, J., Henke, N., & Ostojic, I. (2021). The top trends in tech. Retrieved from https://tinyurl.com/5cyhfx56

[56] McKinsey & company. The top trends in tech-executive summary download. Retrieved from https://tinyurl.com/28hkwfe4

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These trends are expected to **expedite technology advances and applications** in business **carrying NGI innovation along with them**. In the next decade for instance, according to entrepreneur and futurist Peter Diamandis, we will experience more progress than in the past 100 years combined, as technology reshapes health and materials sciences, energy, transportation, and a wide range of other industries and domains. The implications for corporations are broad. Consider the compressive effects on value chains as manufacturers combine 3-D or 4-D printing with next-generation materials to produce for themselves what suppliers had previously provided and eliminate the need for spare parts. Watch retailers combine sensors, computer vision, AI, augmented reality, and immersive and spatial computing to wow customers with video-game-like experience designs. Imagine virtualized R&D functions in science-based industries like pharma and chemicals or a fully automated finance function in your company.

Emmer, M. (2020)[57], the President of Optimize Inc., which specialises in strategic planning, states that one learning from the pandemic is the need for a new construct and mental model for technology. Central to the next wave of innovation and productivity will be "third platform" technologies - those that mark the convergence of mobile, cloud, IoT, blockchain, AI, big data, and robotics. The confluence of these technologies is completely altering how we live and transact and will drive decisions on how we make money. Companies are looking for solutions more nimble than traditional Enterprise Resource Planning applications. They can find such utility in a litany of apps that provide reporting in real time.

Against this backdrop, the main technology trends that management teams should be targeting to harness include: (i) **Robotics and automation**; (ii) **Click and mortar;** (iii) **Extended reality (XR)** – virtual and augmented reality (VR/AR); (iv) **AI-enabled engineering and manufacturing**; (v) **Cloud**; (vi) **Privacy-based computations**; (vii) **Cybersecurity**; (viii) **Big Data**; and (ix) **5G technology.**

Moreover, the most mentioned **digital marketing trends**[58] analysed by many experts can be listed as:

1) **AI-Powered Optimization**: artificial intelligence is the technology behind many services, including content creation, chatbots and search engines. AI can also analyse consumer behaviour and search patterns and use data from social media platforms like Instagram and blog posts to help businesses understand how customers find their products and services.
2) **Augmented Reality (AR) & Immersive Technologies:** AR has been more realistic for marketers. Some companies have launched their AR apps, like IKEA. Their IKEA Place app allows users to take a picture of a room in their homes with a smartphone camera to "test drive" IKEA's furniture in it. Users can move the furniture around and check out how it looks from different angles.

[57] Emmer, M. (2020). Technology Trends Facing Business in 2021 and Beyond | Vistage. Vistage Research Center. Retrieved from https://tinyurl.com/mtxxr47j
[58] Dave, N. (2021). *38 Digital Marketing Trends You Can't Ignore in 2022*. Single Grain. Retrieved from https://tinyurl.com/2p8xwbax

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3) **Predictive & Augmented Analytics:** The differences between predictive analytics and AR lie in the technologies used: "Where predictive analytics uses machine learning to predict what will happen, augmented analytics uses machine intelligence to boost human intelligence with the why, so we can work faster and smarter on ever-larger datasets."
4) **Geo-Fencing:** Geo-fencing allows real-time targeting based on a user's location. A target area is defined as, say, within a mile of a restaurant, and when a user enters or leaves this area, they receive a push notification, text message or another form of marketing communication. According to Reveal Mobile, more than 50% of marketers surveyed see restaurants and bars, health and beauty, entertainment, grocery, and pet stores as the top five retail locations for geofencing.
5) **Progressive Web Apps (PWAs)**: Progressive Web Apps are websites that work like mobile apps but whose functionality resembles a native mobile app.
6) **Newer Blockchain Applications**: According to Leandra Monteiro from IBS intelligence, some key blockchain trends to follow in 2022 are:
    a) BaaS (Blockchain-as-a-Service), which represents the third-party creation and management of cloud-based networks for companies in the business of building blockchain applications.
    b) Verifiable Credential and Self Sovereign Identity (Universal Identity), which will offer verifiable, globally resolvable, and privacy-preserving credentials to store and manage from the security of our own devices and can show it to anyone, anywhere.
    c) DeFi (Decentralized Finance), which represents a shift from traditional centralized financial systems such as brokerages, exchanges, or banks to smart contracts on blockchains.
    d) NFT (Non-Fungible Tokens), which are a special cryptographically generated token that uses blockchain technology to link with a unique digital asset that cannot be replicated.
    e) CBDC (Central Bank Digital Currency), a digital form of central bank money based on Blockchain, which is a legal tender created and backed by a central bank.
7) **Mobile Commerce:** Consequently, mobile devices will play a much larger role in the consumer's purchasing cycle.
8) **IoT Advertising:** The IoT (Internet of the Things) represents a network of devices, from smart cars to household appliances to wearable tech, that are connected between each other and the Internet. In this network, the connected devices can gather, share, and analyse information and create actions synchronously.

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Growing small business trends offering opportunities for NGI innovators

At the same time, technology trends that NGI innovators can leverage in order to build compelling **value propositions that address smaller businesses**[59], include:

1) **Artificial intelligence**: Using tech solutions integrated with AI can help save businesses time. As a result, AI is poised to make small business operations more efficient. This can mean a wide range of implementation scenarios, from voice assistants to personalized customer experiences.
2) **Proliferation of 5G:** This advancement is a major step in the development of the internet of things (IoT), as 5G networks are more capable of supporting the influx of interconnected smart devices.
3) **Comprehensive HR tech:** One area that increased in importance in 2020 as a result of the coronavirus pandemic was the need for comprehensive human resources software and tech that will help small business owners keep track of their employees and their needs.
4) **Tech-assisted shopping:** In response to lockdowns and other pandemic-related disruptions, major businesses have used mobile tech, online shopping, and mobile scheduling to create a contactless shopping experience. This high-tech approach to keeping people safe has spread to more than just curb side pickup, which has become a natural extension of existing tech such as mobile payments and terminals.
5) **Remote onboarding:** Onboarding is an integral part of hiring new employees and getting them up to speed with their responsibilities and the company culture. Without the ability for people to connect in person.
6) **Software unification:** In the modern workplace, more and more tech solutions are becoming popular for communication. The companies will use integration platforms which allow any software to connect well with any other software used in the company.
7) **Focus on cybersecurity:** during the pandemic the amounts of the cyberattacks has risen. Many small businesses have been affected by cyberattacks and data breaches. Thus, the main target for small businesses is to make security measures such as a comprehensive backup-and-disaster-recovery solution to stay protected, and form new standardized blocking and tackling game plans to keep the business even safer.
8) **Greater emphasis on automation:** owners of business will look at automation as a way to save money and cover problem areas. Examples for small business include online pricing automation to balance profitability and revenue growth, as well as inventory management systems to ensure the perfect amount of inventory is on hand.
9) **Influencer marketing:** Social media influencers and personalised marketing are becoming viable avenues for connecting with customers and showcasing products. Nowadays a business must have a dynamic marketing strategy.

[59] Martins, A. (2021). 10 Small Business Tech Trends - businessnewsdaily.com. Business News Daily. Retrieved from https://www.businessnewsdaily.com/10469-business-technology-trends.html.

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10) **Social media advertising:** While influencers are considered social media advertisers, social media advertising also encompasses other areas, like pay-per-click marketing. Social advertising will continue to grow as a cost-effective and efficient way to target specific audiences.

As many specialists, Brad Houldsworth (2022)[60], Head of Product at Remarkable Commerce suggests, that the adding of social media channels as a sales channel is one of the NGI trends. It's based on the fact that social media platforms have global audiences in the billions and most platforms are evolving to facilitate social commerce so their users can buy products from third-party retailers without leaving the app. The social media have ultimately become central to our lives and our reliance on mobile devices fuel the addiction. Over 90% of social media users access their favourite platforms using a mobile device and 54% use social media to research products. Live shopping is one mobile commerce trend he is expecting to increase this year as platforms like Instagram and Facebook have their own live streaming features. To cater to both the shopper and the retailer, each platform allows brands to link directly to the products they're talking about. He also speaks about the rise of the visual commerce which is the next generation of normal static visuals. It takes marketing to a whole other level as instead of simply using product photos, visual commerce takes it one step further by incorporating other types of content such as user-generated-content, interactive content, engaging and interactive videos, and also the augmented reality.

Current and future trends influencing the NGI business model landscape

In the last two years, when COVID-19 pandemic cut off the social interaction and people all over the world were locked down, all sectors were forced to find new ways how to reinvent themselves. With the transformation of the 'offline world' into the 'online', the **importance of the NGI in everyday life has become irreplaceable**. As above included overviews show, most of experts define as key NGI trends in business the IoT, AI, 5G, AR and XR, cybersecurity and data privacy. They also agree on the fact that importance of the social media, various apps, platforms, live streaming, and also interactive content will increase. People all over the world will prefer the podcasts, real video stories and content which brings them an even greater value. The more valuable the information provided to the people/followers the more often they will come back to follow.

As the level of market uncertainty increases, most traditional business models are under attack like never before. We're seeing a big shift where core business teams are being asked to solve uncertain growth challenges; they're being tasked with exploring new business models[61] and adapting their existing ones. Through the holistic research we can identify some business models such as:

a. **E-Commerce as a Launching Pad**: Small brands, also start-ups, are entering the marketplace via e-commerce platforms that connect them

[60] Houldsworth, B. (2021). 5 Trends That Will Shape eCommerce In The First Half Of 2022. IMRG. Retrieved from https://tinyurl.com/559tztez

[61] Breaking Down Trends in Business Models. The Garage Group. Retrieved from https://tinyurl.com/mpbhz7f9

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directly to consumers. In the Natural & Organic products space, more than 50% of new brands enter the market via e-commerce. One common thread among strategies, used on this platform, is a commitment to quality.

b. **Mission-Driven Business Models**: the quote from Todd Grinnell, reflects the impact off this business model as the best: "The way people think about consumption has fundamentally changed. People want it to reflect their values in every way – as one whole".

Overall, new trends[62] in business models appear to be created by **switching the innovation paradigm from product innovation to service innovation**. The term disruptive business model is exactly used to describe these new markets created by new technological innovations or by old technologies that are used in new ways. **Other approaches for business model innovation** based on technological change and developments are concentrated in several categories[63] such as:

1) **"Cost obsession" (low-cost)**: the idea is to get rid of frills and make use of economies of scale, scope, utilization, experience, and other factors for the benefit of consumers.
2) **"Platform"**: this term refers to business models that support two or more markets at the same time.
3) **"Global business"**: business models that opens up to the world in a brief lapse of time (Mango, Zara). Swift globalization is key.
4) **"Seeking excellence"**: companies with this approach focus on innovation, surprise their customers with new features, and satisfy needs which were not even there when the product comes out (Apple).
5) **"Distinctive/adapted"**: "Distinctive/adapted" approaches impose the tough challenge of maintaining a sufficient standard of distinctiveness. Speed of adaptation is the key to winning the ongoing race to be first with what the consumer wants at the given time—the best she can get at that moment, because there is no other comparable choice. This model has earned itself the name "long tail."

Finally, it is important to note that, just like the trends influencing them, the abovementioned list of approaches / models for doing business is not exhaustive. Other business models exist as well, with some even being unclassifiable at the moment. What's more, the categories overlap. And this outline based on Ricart, J. E., rather than providing a taxonomy, merely points out features that make a business model "good" at creating and capturing value.

4.2.2 FINDINGS OF THE INTERVIEWS

The literature review on NGI business trends provided evidence suggesting that the future of NGI business is shaped by the confluence of diverse factors, driven

[62] Phemonoe Lab, & Emetris consulting. (2016). 2030 A changing Europe in a different World. Trends & Business Models. https://tinyurl.com/39hmt8tj

[63] Ricart, J. (2015). Business Models for the Companies of the Future | OpenMind. OpenMind. Retrieved from https://tinyurl.com/ydvjtfkm

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by dynamic technological, economic, legal, policy and social dimensions. The interviews with NGI experts further attested to the validity of this evidence, while also revealing insights into factors that had initially flown under our radar.

Along these lines, this section proceeds by synthesizing the insights stemming from our interviews with respect to: (i) technological advances and megatrends that seem to drive and enable progress in different NGI areas; (ii) the growing emphasis on cybersecurity and privacy in line with EU regulation and the pillars of NGI; (iii) the impact of the COVID-19 pandemic on accelerating progress and change; as well as (iv) future business models pathways in the EU context.

Technological advances and mega trends

The opinions of the experts we interviewed appeared to converge with respect to the technological megatrends that are expected to significantly influence the future of NGI business models and applications. In particular, advances in the fields of **Artificial Intelligence** (AI), **Extended Reality** (XR), **Big Data** as well as **communication technology** were found crucial by most interviewees.

Indeed, many interviewees highlighted the importance of **AI advances**, which may present a "**game changing**" potential for several diverse applications in industry and society, ranging from life sciences and robotics over to learning and criminal investigation. At the same time, however, they also stressed the importance of addressing the ethical issues being brought forward by these AI advances. For instance, some interviewees mentioned that there is a growing need for improving our ability for better understanding and explaining AI decisions (considering the complexity of a given system). As a result, it seems that the **demand for explainable AI is increasing**, driving businesses towards the design, development and deployment of trustworthy applications without AI bias.

The importance of **developments in XR** was also emphasized during our interviews, including Virtual Reality (VR), Augmented Reality (AR) as well as Mixed Reality (MR) applications. XR advances, as highlighted by an interviewee, appear to be driving the development of **"sci-fi" applications in the real world** with **promise for introducing benefits** and improvements across many aspects of our economy and society along with respective **business opportunities** (applications in medical settings, education and training, product design and prototyping, etc.). Not unlike AI advances, however, XR technology developments come with their own **challenges that will have to be overcome** for respective commercial applications and businesses to thrive (e.g. wearing AR/VR headsets on ears and eyes may lead to subtle health effects such as headaches or eye strain).

Along similar lines, the findings from our interviews with NGI experts suggest that the **growing amount of data** collected and generated globally is expected to serve as a **key enabler for technological advances and NGI business models** alike. In this respect, several interviewees highlighted the crucial role of Big Data. It appears that the valorisation of **Big Data can offer the foundations** for leading our data-driven business era forward, helping NGI businesses to link and enhance the value offered by different technological applications (e.g. blockchain, crypto currencies, robotics cloud computing). An interviewee also stressed the untapped **potential of "small data" for providing meaningful intelligence** that can help NGI businesses build more appealing value propositions to improve the life and/or

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work of their customers. Overall, it seems that data (be it big or small) and by extension, **data analytics** can be crucial drivers for the future of NGI business.

Last, but not least, the insights collected during the interviews indicate that **advanced communications technologies and infrastructure are essential** for the future growth of NGI business. As highlighted by an interviewee, current communications infrastructure may not be able to handle the potential of NGI. For instance, at the moment **5G technology** offers many benefits for citizens as well as businesses (e.g. increased and more reliable connectivity, faster data transfer rates, etc.), yet the future growth of NGI will need to build upon even more advanced **technologies and infrastructure (e.g. 6G) with increased security and capabilities** that allow for more efficient transfer of the vast amounts of data that the NGI is expected to bring. According to the interviewees, many communication equipment manufacturers are already working towards this direction across the world (incl. European companies) shaping the future of communications today.

The growing emphasis on cybersecurity and privacy

In the context of rapid technological advances and data growth, the findings from our interviews indicate that **cybersecurity is of paramount importance** with the **potential to have major implications** for the future of NGI business. Indeed, based on many of our interviewees, building trust in NGI solutions would be a key prerequisite for their acceptance by customers, be they organizations or consumers. It seems that, albeit cybersecurity threats (e.g. ransomware attacks) may be currently acting as **a restraint for NGI businesses in the market**, they also provide the **driving force required for major improvements** in the future (e.g. via privacy-preserving computation techniques), in line with the NGI pillars.

At the same time, as many interviewees highlighted, cybersecurity is especially vital in the context of the EU. European policies and regulations place strong **emphasis in protecting the privacy and digital rights of European citizens** (e.g. through the GDPR). Along these lines, insights extracted from the interviews suggest that the growing need to mitigate cyber-security risks can lead to **advances in cybersecurity capabilities** in terms of software as well as hardware architecture. These advances can enable businesses to more sustainably integrate **openness in NGI business models**, better balancing open access with ownership, while also building customer trust in line with EU ethics and social values.

The impact of the COVID-19 pandemic on progress and change

The impact of the COVID-19 pandemic on NGI business trends emerged as a predominant theme across the majority of the interviews. In particular, according to many interviewees, it appears that the pandemic has **catalysed digitalisation** trends across several industries, **fast-forwarding progress** and introducing shifts in work patterns and business models (e.g. increased online shopping, replacing physical meetings and travels with video conferences, etc.). NGI business models are no exception. Several interviewed NGI experts pointed out that health and social measures taken to halt the COVID-19 pandemic (e.g. lockdowns, remote working) **enhanced the use of the internet, online systems and cloud solutions** more than ever, bringing about changes which may benefit and accelerate the development and commercialisation of NGI solutions in the long run.

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At the same time, however, the findings from our interviews suggest that the **impact of the COVID-19 pandemic is not all roses for the future of the NGI**. Many businesses that are seeking to drive value from NGI solutions are currently experimenting with different business models to find and tailor the one which will best fit their needs and market. In this context, as some interviewees highlighted, the COVID-19 pandemic induced **economic uncertainty** across many industries and market sectors, which can lead to increased risk aversion amongst some NGI innovators. This may in turn **constrain NGI (business model) innovation** as businesses and their innovators choose to opt for "safer", more tested business model pathways that imply reduced risks to their financial sustainability within an already dynamic, competitive and fast paced external environment.

Future NGI business model pathways in the EU context

The findings from our interviews indicate that **customer-centricity** is expected to play a crucial role in shaping the future of NGI business models. Along these lines, interviewees highlighted that **Anything as a Service (XaaS) business models** with a customer-centric dimension by design can help the NGI era transition from a product-based approach over to a service-/outcome-based approach to doing business. This can help NGI businesses to deliver **enhanced customer value** by providing solutions that better meet market needs, while at the same time also **increasing revenues and safeguarding financial sustainability**. Moreover, according to our interviewees, XaaS business models build upon and leverage **close interaction** of customers and businesses with **two-way engagement**. In doing so, businesses have the opportunity to establish continuous feedback loops with customers, utilising their feedback in order to better tailor NGI value propositions to actual market demand. In this context, NGI businesses are offered with a **potent tool for driving customer loyalty and empowering customers** to go beyond their typical role (i.e. as simple users of a product / service) in order to **actively shape and improve their experience**. In result, by making the most out of this opportunity, businesses can better service their customers and increase customer loyalty, while enhancing Customer Lifetime Value (CLV) along the way.

Along similar lines, insights from our interviews also hint towards a trend for more **open and blended business models** that can enable innovators to offer NGI services well-adapted to customer needs (in terms of delivery speed, adjustments, etc.). According to some of our interviewees, the on-demand approach could perhaps be one of the most viable ways for NGI businesses to deliver such services in the future. Indeed, it appears that many of our interviewed NGI experts expect that **on-demand services and business models may grow in popularity** across many (European and international) markets, provided they are well-positioned in the market and offer fair value to their customers.

Ecosystem-based models may find increased applications by NGI businesses as well, according to our interviewees. Such models comprise constellations of actors that, albeit not linked by any structure, are connected in **complementary systems** working together with different roles in the value chain, altogether creating better solutions for their customers. As such they can provide NGI innovators with a **broader reach** along with additional (oftentimes specialized) **knowledge, networks and resources** to create and deliver higher value, while also sharing benefits with all other actors of the ecosystem.

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In view of these emerging opportunities, some interviewees highlighted that **the EU may not be as ready for the future of NGI business models just yet**. For instance, the ease of access and ease of payment across countries are two key aspects that can be improved further to facilitate business (e.g. in case of subscription-based services expanding to different countries). Another area for improvement mentioned by our interviewees pertains to data protection regulation. Albeit essential for protecting our rights, vague or difficult to interpret regulatory provisions as well as differences between countries can increase uncertainty in businesses, hindering the development of respective models. Overall, the findings from the interviews indicate that **legislation in the EU digital market needs to keep pace with NGI developments** in a way that protects the rights European citizens, while also allowing for new business models to grow.

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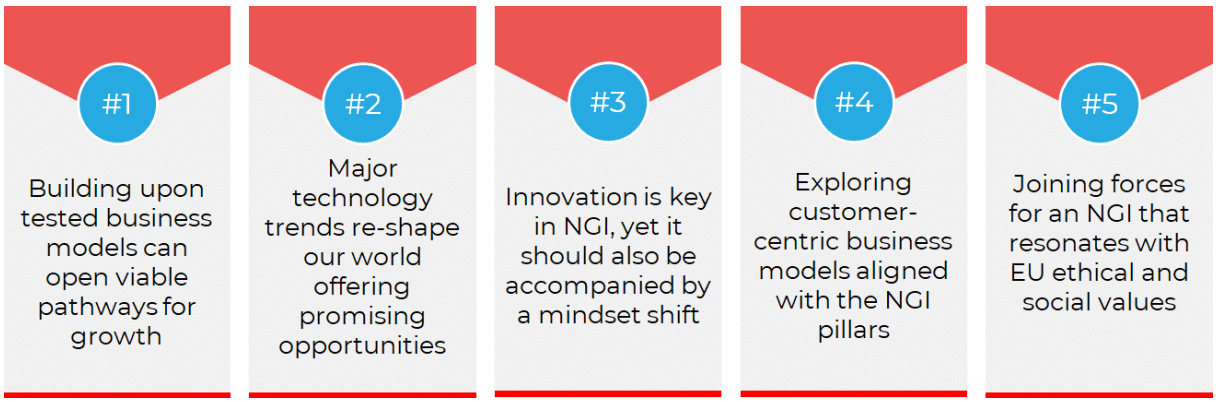
5 CONCLUSIONS

This report set out to explore and reveal current and future trends with the potential to shape NGI business. To this end, building upon the knowledge base created over the course of TETRA, a literature review was conducted, enabling us to unearth and compile existing evidence on NGI business models as well as on the trends that appear to be driving their evolution across different dimensions (technological, economical, legal, etc.). The findings of the literature review were then discussed, validated and enriched via a series of interviews with NGI experts, providing us with further insight into the driving forces bringing the NGI forward.

Along these lines, in this final section of the report, we use the findings from the literature review and the interviews as a platform to draw meaningful conclusions along with practical implications for NGI beneficiaries and stakeholders with respect to the potential future directions of NGI business (Figure 10).

FIGURE 10: OVERVIEW OF CONCLUSIONS



Building upon tested business models can open viable pathways for growth

There is already a plethora of different business model archetypes available for NGI beneficiaries, offering great potential to open up viable pathways for commercialisation and growth. Indeed, while we may not be able to speak with absolute certainty of what the future will hold for NGI business, there are definitely several tested and proven models which are being used in the market now and can offer the building blocks for successful ventures. In particular, our findings show that business models which provide Software as a Service (Saas) or open-source solutions coupled with added value services to create revenue streams as well as subscription-based models are the ones more relevant and aligned with the NGI at the moment. Shining examples and success stories of businesses employing such models in practice to commercialise a wide array of products and services have helped familiarise many diverse market sectors and customers with them. As such, these models can offer a trustworthy approach for starting and scaling up NGI business, along with the option to adapt and evolve into other models as market demand and conditions change in the future (e.g. with NFT transactions, on-demand services or ecosystem-based models).

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Major technology trends re-shape our world offering promising opportunities

The findings from our study leave little room for debate about the fact that we live in an era of rapid technological advances and digitalization. Meanwhile, the COVID-19 pandemic appears to be acting as a catalyst, further expediting the adoption of (digital) technologies amongst individuals and organisations alike. As such, major technology trends are reshaping many aspects of how live and work, fueled by the increasing amount of data generated around the world and driven by developments in AI, XR and IoT as well as in cloud computing and communication technologies, all along with the need for increased cybersecurity and privacy. Against this backdrop, NGI beneficiaries have many opportunities to harness these trends and deliver compelling value propositions (e.g. AI-powered optimisation, cloud robotics, autonomous cooperative machines, multi-user AR experiences, predictive analytics, etc.). The race to seize these opportunities is already on with many businesses (from start-ups over to larger enterprises) competing to gain and keep the lead. In this context, disruptive innovation can be key for businesses that want to jump into the fray and remain sustainable in the longer term, with a view to securing a place in the NGI value chains of the future.

Innovation is key in NGI, yet it should also be accompanied by a mindset shift

Technological innovation, albeit crucial, is only part of the equation in NGI business. NGI beneficiaries aspiring to sustainably commercialize their solutions and establish a firm footprint in the market need to shift their way of thinking and develop an entrepreneurial mindset as well. This way of thinking can help them identify the opportunities (be they economic or social) that lie within research questions and technical problems along with pathways for turning these opportunities into business. Such pathways can lead to (innovative) business models that effectively deliver customer value and build a (loyal) customer base with the critical mass required to generate revenues not only for safeguarding the sustainability of the business, but also for fueling further innovation and growth. A crucial component for growth in this context is the creation of a strong network. Indeed, our findings indicate that it is vital for NGI innovators to build good partnerships with other actors in their ecosystem, be aware of what others are doing and seek to complement instead of competing with them. These ecosystems can help connect NGI businesses, promoting the cooperation, cross-fertilisation and (open) innovation that can usher us faster into the future NGI era.

Exploring customer-centric business models aligned with the NGI pillars

Finding the proper business model is not easy. NGI beneficiaries need to factor in multiple dimensions while designing their business model, and approach this as a continuous process of exploration and improvement, rather than a one-off decision. This includes dimensions of their internal (e.g. value proposition, human and financial resources, culture) and external environment (market conditions, legal and regulatory context, etc.). More importantly, our study has shown that placing customers and their needs at the center of business model design can be key for NGI business. A customer-centric approach can help NGI beneficiaries direct their value propositions to real world demand as well as to engage their customers in the process of improving them. By leveraging customer insights, they can also better grasp market trends and explore avenues for adapting their business model accordingly, to generate greater revenues and shareholder value.

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In the context of the NGI, however, increased revenues and shareholder value should only be part of a bigger picture. Alignment with the foundational values of the NGI is important as well (e.g. inclusion, trust, sustainability), with a view to avoiding externalities which may adversely impact our environment or society.

Joining forces for a NGI that resonates with EU ethical and social values

The NGI, along with its human-centred technologies and applications, offers great promise for improving many aspects of our lives. At the same time, it also brings forth important ethical and social dimensions which need to be carefully considered and addressed under the frame of NGI business models. Nowhere is this more evident perhaps than the case of data-driven business models, which create and capture value from large amounts of data (e.g. using AI to extract meaningful intelligence from Big Data and embed autonomy into networks, connected objects and/or services). With risks such as cybersecurity threats and personal data breaches looming over them, NGI beneficiaries need to process data securely and responsibly, in a way that respects and safeguards the interests of their customers along with the rights of citizens in line with the NGI pillars.

With that in mind, it may come as no surprise that our findings indicate that trust has a key role to play in driving the adoption of NGI technologies. By extension, developing trustworthy solutions and trusted relationships become crucial parts the sustainability of NGI business models. To this end, one-sided efforts from businesses may not cut it. An enabling framework needs to be set in place connecting innovators with other actors (public authorities, research institutes, citizens etc.) to work together, co-create and test trustworthy innovations. Along these lines, the role of European policy makers becomes paramount for shaping framework conditions that keep pace with technology trends and stimulate business growth in line with European values, while also timely identifying and addressing any gaps that may arise in the process (e.g. in terms of resources, knowledge, and skills) with appropriate support measures.

In doing so, policy, research, business, and society can align and jointly work side by side towards building and realizing a shared vision for the NGI of the future.

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