Tech Trends 2022 by
HCL Technologies

Powered by the Enterprise Technology Office
(ETO)

Contents

Executive **summary**

It won't be an exaggeration to say that the last two years were "unprecedented, apocalyptic, and unrivaled for" in every sense of the word. The pandemic inflated the role of technology manifold making it a driver of not just running businesses but also bringing innovation.

Now, as we begin our journey toward a Covid-transformed world, constant innovation and vigorous adaptation to perpetual change are the two primary factors that will define the success of organizations in the nearing future.
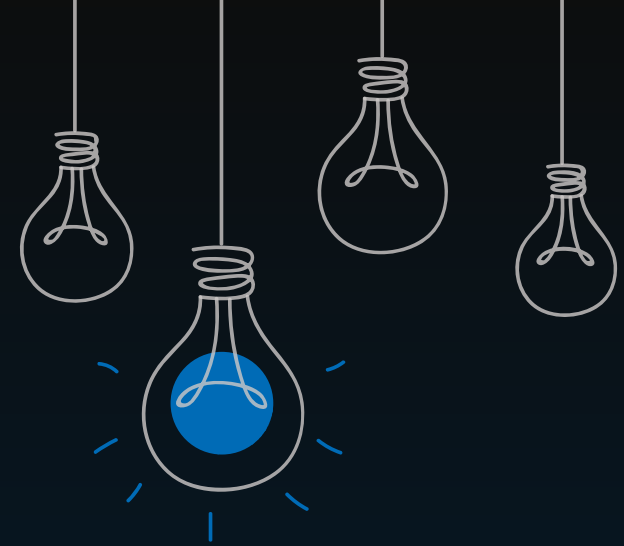
ETO is back with its yearly ritual of sharing the latest insights on technologies redefining the future of businesses. Over the last five years, ETO has been working tirelessly on elaborating how industries look at a changed world due to monumental impacts brought by continuous innovations in the tech ecosystem.

The ETO Technology Trends is an annual exercise partaking a holistic approach that is both diverse and converse in nature. The trends are backed by our proprietary research framework encompassing discussions with VCs, leading technologists and market leaders across geographies. These discussions are also accompanied by extensive secondary research done by analyzing various technology reports, analysts' reports, news mentions, investment trends, and podcasts from VCs.

The report highlights the importance of ecosystems as a strategy and the pressing need of interdependency among beneficiaries, especially now than ever. It can be used for charting out technology priorities in your future ventures to build an innovative future powered by ecosystems. We hope that our intended readership finds the ETO Technology Trends 2022 inspiring, insightful, and impactful.

Innovating your way into the post-pandemic era.

Technology will continue to transform the way we live and work, and the pace will only rise.

30%*

upward market outperformance witnessed by companies that invest in innovation through a crisis

*McKinsey survey

Top 10 Technology Trends for 2022

From blockchain trying to catch back steam and Quantum Computing getting a mainstream cloud push, to 5G with a full green signal ahead and hyperautomation gaining traction, these trends are generating big breaks for exponential enterprises.

Changing business perspectives & key technology drivers in a covid-transformed world

- Observations over evolution of technologies in the last half-a-decade
- Key changing business imperatives from digital transformation to the giant leap toward ecosystem are highlighted

Key areas covered in the report

5-year trend realization

- Top technologies and how they have moved toward the adoption cycle are showcased
- Four levels of technology innovation are shown: hype, disruption, adoption & standardization

Rise of Ecosystems: A key business imperative

- It defines key business continuity, innovation imperatives and key tenets in a Covid transformed world powered by a robust ecosystem strategy.
- Also helps align what key technologies to look out for.

Top 10 ETO Technology Trends for 2022

The trends are based on reflections formed from market research and ecosystem sentiments. They are liable to change based on market dynamics and may only cover a part of the technology landscape. Our goal here is to draw upon the research and experience from our ecosystem of startups, VCs, academia, customers, innovation forums, government trade commissions to advance the conversation on a broad spectrum of topics of interest to CXOs.

Here are the identified trends that will shape the technology landscape next year

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2022 Technology Trends

Progressing toward a responsible AI
AI as a game changer for organizations to emerge resilient and responsive in a post-pandemic world. A responsible AI to take the center stage.

Hyperautomation - Driving digital transformation
An orchestrated use of RPA, BPM, and Advanced Analytics for cautious deployment of automation solutions.

Quantum computing and cloud at the cross-roads
Organizations will continue streamlining quantum computing services through cloud to achieve new breakthroughs

Experience-first strategy at the core
Organizations are accelerating adoption of a wide spectrum of digital technologies like digital experience platforms (DxPs)

Cybersecurity defining grounds for hybrid work models
With the advent of more hybrid work models and increased SaaS platforms, cloud security will be an increased area of investment

Push towards 5G adoption
The pandemic has accelerated the requirement of better connectivity, hence adoption of 5G has garnered pace.

IoT device usage accelerating with complementing tech
With rise in the salability of connected devices, IoT platforms are likely to gain traction.

Generative AI and 3D printing will complement each other
Increased demand of virtual prototyping, generative design and AI-based requirements are also increasing the use of 3D Printing.

Blockchain – A push toward consumerization
Pivoting in pilot stage, blockchain holds the potential to sculpt changes in the coming years with the advent of NFTs and national cryptocurrencies

Eyeing for a sustainable future – Green IT leading the way
Sustainability is becoming central to the organization's technology priorities in line with the UN-SDGs

Trend 1

Progressing towards responsible AI

Delivering business impact from AI implementations will become easier as industry-specific solutions will come to life, making it relatively easier for business teams to try their hands on AI use cases. The post-pandemic scenario will take AI to the top of the corporate agenda, empowering business resilience and relevance. Ethics will be mandatory in AI implementations having human-centric solutions.

Investment
USD 88bn (2x from FY'20)

Market size
Expected to grow from USD 2.61bn to USD 9.88bn for the period 2017 to 2022, CAGR 30.5%

Keywords
Responsible AI, Generative AI, Explainable AI, AI Hardware

Use Cases
AI-powered wearables, healthcare devices

Trend 2

Hyperautomation - Driving digital transformation

Technology advancement has combined RPA, LCAP, business process management (BPM), and advanced analytics have led to hyperautomation that in turn is leading to increased operational costs , low code application platforms (LCAP) reducing development time, and increasing multi-experience support. COVID-19 has pushed organizations to allow more digital-first operations and hyperautomation is the key.

Investment
USD 1.91bn (reduced by 20 Mn from FY'20)

Market size
From USD 481.6bn in 2020 to USD 596bn in 2021, a rise of 24% on average.

Keywords
MLOps, COPA, BPM, LCAPs

Use Cases
Manufacturing automation using low code platform and reducing dependency on IT

Trend 3

Quantum computing and cloud at the cross-roads

Cloud Computing has stabilized its position as one of the most valuable technology and was a lifesaver in pandemic. Quantum computing on top of cloud helps creating super-powerful encryption and is used in the area of experimental research and development. Organizations will continue streamlining quantum computing services through cloud to achieve new breakthroughs.

Investment
USD 1.66bn (Increased from USD 614mn FY'20)

Market size
USD 161mn by 2022 from USD 33mn in 2017 at a CAGR of 37.3% for the period 2017-2022.

Keywords
Qubits, Quantum, Quantum Computing, Quantum Computers, SuperComputer

Use Cases
Intelligent traffic optimization, new material discovery

Trend 4

Experience-first strategy at the core

Keeping experience at the core of business and end users, organizations are accelerating adoption of a wide spectrum of digital technologies, like digital experience platforms (DxPs) and AR/VR or even extended reality (XR) for enhanced customer experiences accessible in all forms of devices.

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Investment
USD 2.8bn (Down by 1/3rd from FY'20 due to reduced deployments)

Market size
Market size is forecasted to grow up to USD 209bn by 2022

Keywords
Responsible AI, Generative AI, Explainable AI, AI Hardware

Use Cases
Training using AR technology and holograms

Trend 5

Cybersecurity defining grounds for hybrid work models

With the rapid and widespread adoption of remote work following COVID-19, the necessity for cloud-based services and infrastructure increased drastically. Going forward, this trend will only continue to grow as more businesses adopt cloud-hosted processes. With the advent of more hybrid work models and increased SaaS platforms, cloud security will be an increased area of investment along with scouting talent and awareness initiatives.

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Investment
USD 21.5bn (1.5x from FY'20)

Market size
Projected to grow from USD 217.9bn in 2021 to USD 345.4bn by 2026

Keywords
User awareness, Cloud Security, Geo-Targeted Phishing Threats, Phantom Phishing, SASE, XDR

Use Cases
Monitoring unusual activity, Man-in-the cloud attack, data ex-filtration, unsecured storage condition

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Trend 6

Push towards 5G adoption

After many successful 5G trials, manufacturing and healthcare to see first adoption success. Open Radio Access Network (O-RAN) is getting more attention to provide telecoms an alternative way to build networks based on disaggregated RAN using non-proprietary white-box hardware, open-source software from different vendors, and open interfaces.

"Morgan Stanley estimates that the industry will spend USD 225 billion on 5G between 2019 and 2025, with the biggest outlays coming later" - 5G Wireless Challenges and Predictions, Morgan Stanley

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Investment
USD 370mn (increased by 3Mn from FY'20)

Market size
Global 5G adoption of smartphones is expected to hit 1bn in 2022 (2x from 2021)

Keywords
sub-6 GHz, mmWave, O-RAN, 5G and IoT, Zero Energy Devices

Use Cases
Transferring data with higher bandwith for autonomous or remotely operated vehicle

Trend 7

IoT device usage accelerating with complementing tech

As connected machines become more salable, IoT platform development and security will be a major focus leading to increased smart devices. Satellites, along with other low-power network technologies and 5G, will increase connectivity for the deployments of IoT. Asset tracking, inventory management, data sharing, driving real-time insights will accelerate IoT usage.

Investment
USD 2.7bn (increased from 2.1Bn in 2020)

Market size
The global internet of things market size is projected to reach USD 1464 Bn by 2027

Keywords
IoT and Edge Computing, IoT and 5G , IoT and AI & Cloud

Use Cases
Smart world using more and more IoT devices like smart watches, smart homes etc

Trend 8

Generative AI & 3D printing will Ccomplement each other

One of the steady growth industries with 12.5% growth Y-o-Y, 3D printing is stabilizing gradually, and some segments of additive manufacturing are starting to flourish- 3D printing, metal additive manufacturing, and 4D printing for the medical sector. Increased demand of virtual prototyping, generative design and AI base requirements are also increasing the use of 3D Printing.

Investment
USD 1.9bn (reduced by 1/2 from FY'20)

Market size
The global 3D printing market is expected to grow from USD 12.6bn in 2021 to USD 34.8 billion by 2026

Keywords
Additive Manufacturing, 4D Printing, Virtual Prototyping, Layer, Monomer, Freeform

Use Cases
Designing automobile equipments using 3D printing to analyse the actual product

Trend 9

Blockchain – A push towards consumerization

The possibilities of blockchain are endless. In 2021, with the advent of Non-Fungible Tokens (NFTs), traceability and emergence of national cryptocurrencies, we have come one step closer to a decentralized, trustless internet with increased transparency in transactions. This propagates blockchain-as-a-service avenues. Yet to realize its full potential, blockchain technology, in the coming years, will require more governance as it reaches from enterprises to hands of consumers.

Investment
USD 18.7bn (6x from FY'20)

Market size
Expected to grow from USD 411.5 Mn in 2017 to USD 7,683.7mn by 2022, at CAGR of 79.6%

Keywords
NFTs, Traceability, Cryptocurrencies, Loans, P2P lending, Cryptography, Decentralization

Use Cases
Consumers digitalising their assets using NFTs

Eyeing for a sustainable future – Green IT leading the Way

Sustainability is becoming central to any organization's technology priorities in line with the UN-SDGs. This leads organizations to use green technology solutions, resulting in a waste-free world with increased emphasis on climate action, clean air, renewable energy, and net-zero emissions.

Investment
Total sustainable investment seen in GSIA for 2020 USD 35.3tn

Market size
Global ESG assets may exceed USD 53 Tn by 2025

Keywords
ESG, Sustainability, Green IT, Environmental, Social

Use Cases
Alternate methods of disposals like battery buy back, energy saving using adjusted power plans
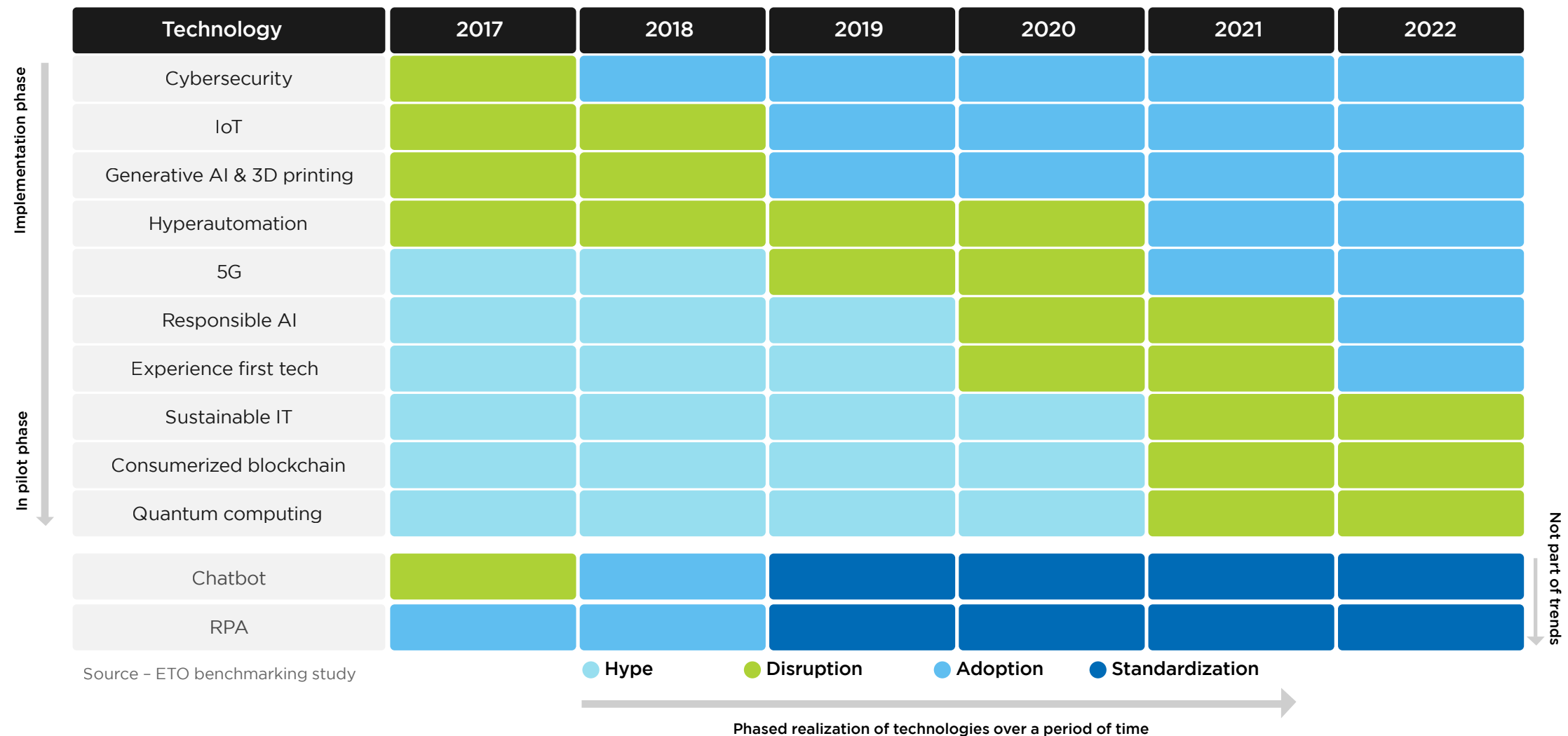
Trend realization over the years (2017-2022)

Based on our proprietary weighted average benchmarking method, the trend realization table marks various technologies across four broad phases – hype, disruption, adoption & standardization. The shape of the technology life cycle is often referred to as the S-shaped curve (detailed description on page 17) that outlines each of the above defined phases accurately.

The first stage i.e. the **hype** phase represents the innovation or birth of new advancements. Over a period of time, technologies in the hype phase surpass to enter into the next stage of **disruption.** From here on, the technology either creates turbulence in the existing market or creates a completely new market segment. This is also the stage where proof of concepts (POCs) come into picture in order to bring the technology into its realization phase and to demonstrate its feasibility. New teams get established and the emergence of new talent also takes place in lieu of the innovative tech developed.

The **adoption and standardization** phase comes with penetration of newly developed technology in the market and its wide scale adoption by potential users. It is toward the end of this phase, that the technology doesn't remain new anymore as its commercialization stage arrives. With the arrival of commoditization phase, we can say that the technology has successfully left the phases of innovation to enter into the world of wide-scale adoption and standardization.

Refer the trend realization table to gauge the adoption of various technologies across 2017-2022 time period.

Technology	2017	2018	2019	2020	2021	2022
Cybersecurity	Disruption	Adoption	Adoption	Adoption	Adoption	Adoption
IoT	Disruption	Disruption	Adoption	Adoption	Adoption	Adoption
Generative AI & 3D printing	Disruption	Disruption	Adoption	Adoption	Adoption	Adoption
Hyperautomation	Disruption	Disruption	Disruption	Disruption	Adoption	Adoption
5G	Hype	Hype	Disruption	Disruption	Adoption	Adoption
Responsible AI	Hype	Hype	Hype	Disruption	Disruption	Adoption
Experience first tech	Hype	Hype	Hype	Disruption	Disruption	Adoption
Sustainable IT	Hype	Hype	Hype	Hype	Disruption	Disruption
Consumerized blockchain	Hype	Hype	Hype	Hype	Disruption	Disruption
Quantum computing	Hype	Hype	Hype	Hype	Disruption	Disruption
Chatbot	Disruption	Adoption	Standardization	Standardization	Standardization	Standardization
RPA	Adoption	Adoption	Standardization	Standardization	Standardization	Standardization

Implementation phase (top) → **In pilot phase** (bottom)

Not part of trends (Chatbot, RPA)

Legend:
- ● Hype
- ● Disruption
- ● Adoption
- ● Standardization

Source – ETO benchmarking study

Phased realization of technologies over a period of time

Observations from trend realization

Cybersecurity
Cybersecurity has been broadly embraced over last few years and will continue to be the most powerful collection of technologies for IT infrastructure

Generative AI and 3D printing/IoT
Success in IoT deployments has led to increased implementations and with the push toward generative AI use cases, 3D printing spend has accelerated.

Hyperautomation
The Covid-transformed world has pushed entities to explore digitalization in full swing leading to company-wide adoption of hyperautomation

Responsible AI
AI has moved up to a point that a more responsible and ethical use has been disrupting the space since last two years and is now gradually moving toward adoption.

Experience first tech
This year will witness a surge in technologies related to enhancing experience. AR/VR/XR/DxPs will play a central role in enhancing the overall customer/user experience

5G
This year will be the year of data speed disruption of 5G, which will also provide a big boost to all the underlying technologies

Sustainable IT
Sustainability has become a common phenomenon in everyday activities. According to a recent McKinsey survey, 40% of the industrialists expect company sustainability programs to generate value in the next five years

Consumerized blockchain
Surpassing the hype and hidden vulnerabilities, doubts about blockchain are fading and technology is seeing more application in the enterprises and consumer domain.

Quantum computing
Quantum Computing is expected to hit a new stage of disruption as leading firms have made breakthrough announcements in 2021 (from the development of 127 qubit chips to proposing a new metric for performance measurement). Now, the movement is toward providing technology access to everyone through cloud.

Metaverse: The next mega trend?

Metaverse holds the potential to change how we will live and interact.
The year 2022 will see innovations that will create several propositions
in and around Metaverse, centered on six core characteristics.

Limitless

There are no barriers between
real and digital and the Metaverse
is endless

Interminable

The Metaverse is always active
and can't be reset or unplugged

Virtual economies

Digital currencies help power fully
functioning virtual economies

Community interactions

The Metaverse creates
strong social links with other
users and AI virtual beings,
creating events meant to be
shared together

Pragmatic

Users can achieve a realistic
sensory experience with extended
reality (XR) tools

Decentralized

No single entity has control
over the Metaverse. All users
have individual agency

Ubiquitous and distributed cloud

Paving the way for a shared and efficient economy

Distributed to different physical locations, ubiquitous in nature, the cloud is helping with low-latency scenarios by reducing data costs. Development of semi-autonomous and self-driving vehicles (cars, drones etc.) is a prominent use case.

Omnipresence of green tech

A necessity for sustainable enterprise

By 2030, carbon sequestration will be commonly used in many nations with various new approaches being utilized for trapping and removing carbon dioxide from the air.

Unlocking qubits

Harnessing the power of quantum computing

By 2035, fully-functional quantum computers could become available to the public both in the cloud and as physical units.

Trends
defining the
next decade

Limitless experience

Exploring the complete potential of metaverse

The coming decade will see experience tech at its peak with technologies like Metaverse coupled with digital currencies, like crypto, witnessing insurmountable growth.

Connectivity at scale

5G and beyond

The successor of 5G, viz. 6G, is estimated to be 100 times faster than 5G. It could also result in virtual reality experiences that feel and look just like real life.

Rise of the Ecosystems – A Key business imperative

For past some years, the innovation activity has been fueled by clusters or ecosystems where finance, academia, industry and entrepreneurs rub shoulders to allow free flow of ideas. Rise of ecosystems is not only significantly contributing during the pandemic but will also play a strong role in our recovery from the pandemic.

The path to a far more resilient and balanced economy is dependent on not just what we innovate but also how we innovate – undoubtedly the way we innovate needs to be changed in order to attain a resilient economy. We are now in a phase witnessing the shift from a 'demand-led' to 'ecosystem-led' innovation strategy. This marks a transference wherein earlier innovation occurred in isolation, it now occurs in collaboration via collective inputs. It is directly proportional to the speed to market and the pace at which innovation occurs. The shift has been elaborated in detail in the figure below

Demand-led

- Leadership
- Suppliers
- IT
- Sales
- Employees
- Business

Ideation in isolation	→ Collective inputs
Simple innovation	→ Collaborative innovation
Slow GTM	→ Faster GTM strategy
Slower innovation	→ Faster innovation
Isolated systems	→ Integrated value portal
Manually driven	→ Automated processes

Ecosystem-led

- Leadership
- Suppliers
- IT
- Sales
- Employees
- Business
- Startups
- Academia

Changing business perspectives & key technology drivers in a covid-transformed world

The Coronavirus outbreak has brought upon twin threats to both lives and livelihoods. It is an undeniable fact that there will be a lot to reflect upon once the pandemic fades into history. The pandemic has brought about years of change in the way companies, across industries, conduct business. To stay competitive in the new business environment, it is imperative for companies to adapt to changes and embrace the technologies forming it.

Changing business perspectives   **Technologies at play**

01 **Digital workplace model**
Adapting to remote working arrangements

Responsible AI	Cloud	Hyperautomation
Cybersecurity	IoT	Blockchain

02 **Innovation for business resilience**
Prioritizing innovation post-crisis by leveraging ecosystem capabilities

AI/ML	Cloud	Quantum computing
Cybersecurity	5G	Blockchain

03 **Quantum leap toward ecosystems**
Transition of "owner of product" to "shared owner" to build resilient businesses

Robots	Cloud	Hardware tech
Cybersecurity	AI/ML	Cobots

04 **Contra-positioning customers and enterprises**
Allowing customers to co-construct making them and enterprises two sides of the same coin

AI/ML	Cloud	Data and analytics
Cybersecurity	5G	XR

05 **Customer experience at core**
Meet the customer demands of experience and personalization, keeping privacy at pivot

AI/ML	Cloud	Sustainable IT	Data and analytics	IoT
Cybersecurity	AR/VR	Blockchain	5G	

Source – BDO & other leading market reports

HCL Technologies has always been identified as the flag-bearer of innovation, staying at the forefront when it comes to adopting new ways of developing the technology infrastructure. Here are the phases of innovation that HCL has adopted over the years –

First Phase
Internal innovation and reliance on R&D teams and labs

Second Phase
Co-innovation with customers wherein experience studios and co-innovations labs were established
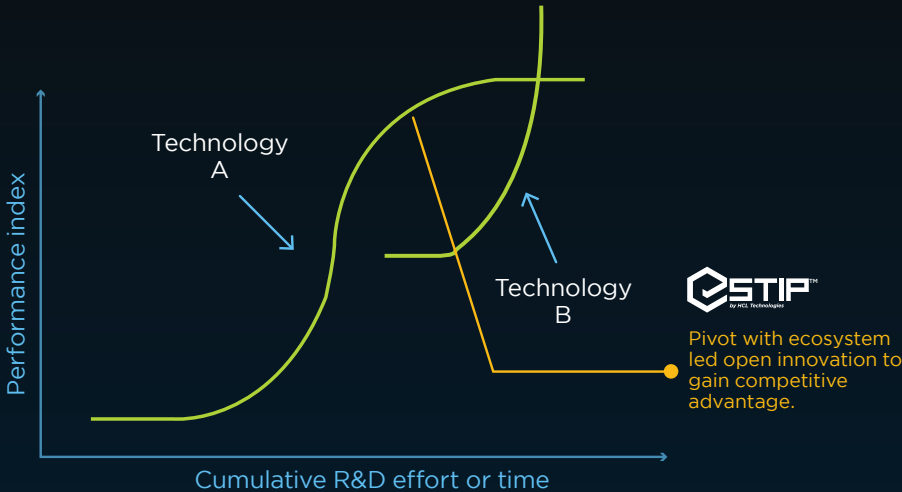
Third Phase
Innovation with strategic alliance partners

Incoming Fourth Phase
Innovation with ecosystem in place (VCs, startups, academia, industry forums)

eSTiP™ is HCL's flagship open innovation platform and program, which is designed to build the conduits between innovative startups and HCL/our clients by adopting a more distributed, more participatory and more decentralized approach to innovation.

COVID-19 has accelerated digital innovation manifold and it is needless to state the importance of decreasing the go-to-market time of emerging technologies. Thereby, making the adoption of ecosystem based innovation model even more necessary.

Exponential enterprises that have established an ecosystem strategy, have seen reduction in overall time for innovation by 50% and resulted in faster go-to-market. The impact of ecosystem-based innovation on the standard S-curve of innovation is elaborated in the figure below :

Technology A

Technology B

Performance index

Cumulative R&D effort or time

eSTiP™

Pivot with ecosystem led open innovation to gain competitive advantage.

Source – Adaption from the innovation S Curve by Christensen, Clayton M.

The pandemic has also highlighted the need for innovation ecosystems to solve dynamic problems of enterprises and individuals.

It's an environment in which people are expecting innovation not only to be fairer but also more evenly distributed, with the fruits of those innovations spread across society rather than coalescing in the pockets of the few.

About ETO trends

The trends are based on reflections formed from market research and ecosystem sentiments. They are liable to change based on market dynamics and may only cover a part of the technology landscape. Our goal is to draw upon the research and experience from our ecosystem of startups, VCs, academia, customers, innovation forums, government trade commissions to advance the conversation on a broad spectrum of topics of interest to CxOs.

Primary research

The trends have been endorsed by leading technologists and market leaders. The responses act as primary inputs for the statistical analysis on the observed trends.

Secondary research

An extensive secondary research has been done by analyzing various technology reports, analyst reports, news mentions and podcasts from venture capitals. After the observation, a statistical weighted average method has been used to evaluate these trends.

Statistical analysis

A weighted average score benchmarking has been created to evaluate and prioritize the technology trends. Parameters taken into consideration for creating this trend analysis are as under:

| News mentions | IT budgets | Funding from VCs | Trend realization | Customers | Market size | Analyst mentions |

Benchmarking the technologies, metrics created by ETO*

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Enterprise Technology Office

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HCL

HCL Technologies (HCL) empowers global enterprises with technology for the next decade today. HCL's Mode 1-2-3 strategy, through its deep-domain industry expertise, customer-centricity and entrepreneurial culture of ideapreneurship™ enables businesses to transform into next-gen enterprises.

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