ELOGROUP

Technology and the transformation of C-level leadership in Brazil

A NEW RESEARCH ON TECH C-LEVEL LEADERSHIP IN BRAZIL REVEALS HOW ITS AND TECHNOLOGY EXECUTIVES ARE REDEFINING THEIR ROLES INSIDE ORGANIZATIONS.

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Summary

Tech C-Level Brazil

THE NEW STRATEGIC POSITIONING OF IT IN ORGANIZATIONS

MIT Technology Review Brazil, in partnership with the consultancy EloGroup, presents the Tech C-Level Brazil research, which explores the challenges faced by Technology executives and the new skills these professionals need to develop to meet the demands of the current market.

Produced in partnership with:

ELOGROUP

EloGroup is a digital transformation consultancy that combines technology, analytics and management skills in an integrated journey to generate value, from strategy to delivery. It has been operating since 2007 and today has more than 650 professionals working in Brazil and internationally to solve challenges in different industries.

REALIZATION

Produced by the TEC Institute and the consultancy EloGroup, the survey aimed to understand how Brazilian CTOs and CIOs deal with market changes and how they can work more strategically within their organizations. To this end, technology leaders from national companies of varying sizes and operating segments were interviewed.

METHODOLOGY

The quantitative phase of the survey, which brought together the participation of more than 110 companies, used questions with a variety of scales in order to make segmented cuts and understand the current stage of the participating companies in technology-related issues. The answers were analyzed separately and correlated to investigate the impact of one answer on another.

In the qualitative phase, we spoke to CTOs and CIOs from companies in various segments. The answers were compiled to provide complementary reflections for the article.

OBJECTIVE

The purpose of the research is to analyze the current IT scenario in Brazilian organizations and the new role of the CTO/CIO within this context. The study also provides an overview of the main challenges, advances and new duties that IT executives must deal with.

By: **LUÍZA WERNECK/MIT TECHNOLOGY REVIEW BRAZIL**

IT AND BUSINESS: AN INCREASINGLY INTRINSIC RELATIONSHIP

Technology executives from various sectors discuss the current challenges in the field, in a scenario where it is becoming increasingly strategic within companies.

By **MIT Technology Review Brazil**

Regardless of the sector or size of the company, nowadays, to remain competitive, you need to use technology - a lot of it. But that alone is not enough. The tools only make sense when they are aligned with the business strategy. It is from this double vision, the fusion of technology and business, that the new CTO/CIO is born. The "Augmented" CTO is the one capable of combining multiple skills to apply a lens on the future, prospecting opportunities with the use of technology and analytics, and directly assisting the CEO's decision-making. Therefore, the era of IT being limited to technical support, delivering demands and solving problems is behind us. Now, in various market segments, these teams are becoming strategic players, integrating with other departments and actively participating in crucial decisions for the company.

The **"Tech C-Level Brazil"** survey, carried out by the TEC Institute - responsible for publishing the MIT Technology Review Brazil - in partnership with the consultancy EloGroup, presents an overview of the main challenges, advances and new attributions that executives in the area currently have to deal with in Brazil.

With technological evolution and the change in IT positioning, organizations are facing new human challenges, especially in attracting skilled professionals who have a deep understanding of both fields.

One of the largest beauty conglomerates in the world, the Boticário Group began a profound organizational transformation in 2019 involving its IT area. Until then, the department operated in the traditional model, basically providing technological support to the other sectors. The team had an average of 200 people, 60% of whom were Project Management Office (PMO) or project managers. Only around 10% were developers.

Since then, the situation has changed completely. Today, IT and business are increasingly integrated, with technology permeating several areas and playing a central role in the creation of digital products and services. IT's role goes way beyond solving problems; it also acts strategically throughout the organization.

According to the survey, scenarios like this, in which technology takes on a strategic role, are still under construction in Brazil. Although 80.9% of CTOs/CIOs totally or partially agree that their companies have a formalized digital strategy, only 30.4% consider their areas to be proactive in supporting the implementation of this strategy, and only 12.2% see IT as a trusted advisor, playing a more strategic role. In addition, 44.3% of CTOs/CIOs define the operating model as centralized, with a single IT team for the entire company, focused on meeting specific business demands, still characterizing IT as an "order taker". Only 16.5% of CTOs/CIOs indicate that IT instigates executives, board members and talent to rethink the business from a technological perspective.

The IT division at the Boticário Group currently has around 3,500 employees, of which around 3,000 are developers, engineers and data scientists. In other words, not only has the team grown more than 15 times, but it is now made up mostly of more qualified professionals, who consequently demand better salaries. This has allowed the group to develop its own platforms and hardly need third parties anymore. The "Tech C-Level Brazil" survey found that salaries and benefits for in-house teams accounted for most of the budget allocated to IT in 2023 within organizations (38.3% of respondents). For 2024, the trend also remains a priority (for 35.7% of respondents).

Technology as a strategic role in Brazil

Research data

80,9%

of CTOs/CIOs say that their companies already have a formalized digital strategy.

44,3%

reveal that they operate with a centralized model, in which one IT team handles all the company's demands.

30,4%

consider their IT areas to be proactive in supporting the execution of the digital strategy.

16,5%

point out that IT is provoking executives and talent to reimagine the business with a technological vision.

12,2%

see IT as a trusted strategic advisor.

But the central point of the revolution within the Boticário Group was to unite the IT area with Human Resources. Today, they are under the command of Daniel Knopfholz, who jokes that he cannot define exactly what his position is. "I do not know which 'C' I am, I define myself as CIO (Chief Information Office) or CHRO (Chief Human Resources Officer) depending on the occasion [laughs]. My experience is as a business manager, not in technology or HR. The decision to put someone with my profile in this position was really to change the situation. Today, we spend more on Technology than on Marketing. The IT cost line is the biggest, and it is fundamental for revenue growth", he explains.

Knopfholz emphasizes that the sectors are not fused. They continue to have separate teams, budgets and planning. Furthermore, it is not something permanent, but a transition period that should last between four and five years. The aim is to guarantee a modern management model that is the standard in the organization, implemented across the board and not isolated on an island of innovation. "We needed to bring technology into the core of the company, get everyone to know how to talk about it and work with people from the area. IT stopped being a support point and became a decision-making element, part of the sales department, which decides the organization's strategies".

"We needed to bring technology into the core of the company, get everyone to know how to talk about it and work with people from the area."

Daniel Knopfholz
Vice President of People and Technology at the Boticário Group

Bringing the sectors together, he adds, has made it possible to speed up this transformation. Strategically, for example, the group went from having around a thousand individual targets to between five and seven collective targets. Today, data scientists are hired for areas such as Marketing, Sales and Finance, something that did not used to happen. Likewise, marketing professionals with in-depth data analysis skills are hired. The group also drew up a three-pillar strategy to define what should be developed internally, without using ready-made solutions from the market.

The first is that everything related to core business needs to be done in-house. "In other words, if the client is going to have contact, it should be done by us. Our website and app, for example. We want to offer unique experiences, so it does not make sense to buy a standard solution".

The second pillar is to internalize everything that is a competitive differentiator, even if it does not go directly to the customer. For example, demand algorithms. There are 15 brands and 15 channels that intersect in different ways, with various buying and selling possibilities. If this algorithm is created by a third party, it will be thrown onto the market, which will mean that the group's expertise will no longer be an advantage.

The third pillar is to develop everything that the market is not interested in. In the past, for example, the group used SAP (an enterprise resource planning software) with 80% customization, which was complicated because any update would bring down the customizations. Today, one with 8% customization has been created, and everything that is a business rule is outside SAP. For example, tax rules that only exist in Brazil and which market solutions cannot and are not interested in covering.

To develop so many solutions, the executive stresses it is essential to have a highly qualified team. And this requires investment, not only financially, but also in an attractive working environment. "We pay competitive salaries, especially in the long term. What is more, today these professionals are part of our company's core business, taking part in key decisions. We also have initiatives such as sponsoring events in the segment and a very close relationship with the developer community".

In this sense, he believes that it is a mistake for an organization to bring the technology sector closer to other areas to reduce costs. "The idea is precisely the opposite. It is to stop seeing IT as a functional service and start seeing it as a fundamental area for the whole business".

The use of Artificial Intelligence (AI) is still viewed with caution. The executive points out that generative

AI will be useful mainly in customer service, making interactions more interesting and less mechanized. “We are cautious and still prefer a humanized service for sales. We do not follow fads. When the metaverse came along, we did not create a specific area for it. The same happened with 5G”.

He adds that predictive AI, however, is used at scale, involving 400 engineers and data scientists. “We use predictive AI for issues such as dynamic pricing, offers and loyalty”.

Technology needs to enable the construction of scenarios that the business areas themselves often cannot imagine. The CTO/CIO is then no longer just an enabler, but also a driver.

Matheus Americano,
EloGroup Partner, responsible for technology practice

Augmented CTO

The market is witnessing a transformation in the profile of the CTO/CIO. According to Matheus Americano, the EloGroup partner responsible for the technology practice, “technology has always played an enabling role. It is just that in the past it delivered the best solution based on a demand, a driver from the business area. Nowadays, technology needs to enable the construction of scenarios that the business areas themselves often cannot imagine. The CTO/CIO is no longer just an enabler, but also a driver”.

For Americano, this new role needs to combine business and technology skills in a balanced way, going beyond traditional models. “The Augmented CTO, as we call this new profile, is a professional who not only understands technology in depth, but also masters the nuances of the business. It is no longer a question of a technology executive who understands a bit about business or vice versa. This profile needs to be proficient in both sets of skills to have all the variables and answers needed to make decisions”.

“This whole movement is a consequence of the great wave of Digital Transformation we have seen in the market in recent years”, explains Americano. “Companies have adopted a series of operational processes and frameworks that have been fundamental in enabling the demand for the Augmented CTO to arrive. The processes, unfortunately, however enabling, have not completely transformed the way decisions are made. That is down to people”.

“For the transformation to be effectively successful, we need more than a good model”, he says. “You need leaders who understand the context in which they are immersed and who can get the most value out of it. For me it is almost a response from the market saying: ‘you asked for it? Then get out there and make a real difference’”.

“Technology has always been part of the business”, states the EloGroup partner. “Decisions, such as creating a service bus, or making a massive move to Public Cloud, have always had the main objective of preparing companies for the future. But the technical nature of the discussions and the segregation between Business and Technology has created a comfortable ecosystem for these choices to be mistakenly taken as the sole responsibility of IT and not discussed as a business and with the business areas”.

The executive points out that, throughout the work carried out with large Brazilian companies, the consultancy has identified 16 key roles that can be played by the Augmented CTO. “In our technology projects, one of the first steps is to define the strategic positioning of IT within the organization. This set of roles was developed empirically, based on real experiences, and has proved to be a very useful tool for directing discussions with technology executives right from the start”, explains Americano.

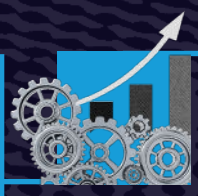
These roles illustrate the need to balance technological and business skills, adapting to the strategic and operational needs of each organization. Americano indicates that the modern CTO/CIO is someone who relates very well, influences, challenges and drives the digital strategy, anticipating the needs of the market and the organization itself. Below are the main roles of the Augmented CTO.

Here are the main roles of the Augmented CTO.

CTO/CIO'S 16 KEY-ROLES

IT STRATEGIST

Develops IT strategies aligned with the company's business objectives.



BUSINESS DIGITAL STRATEGIST

Aligns digital technologies with business strategies, playing a leading role in their development.

DIGITAL & AI PLATFORM BUILDER

Designs and builds modular and integrated platforms and services to drive business efficiency, scale, and adaptability.

DIGITAL PRODUCT & SERVICES BUILDER

Develops, enhances and manages internal business capabilities and/or innovative digital products and services for the market.

IT OPERATIONAL MODEL EVOLVER

Transforms IT operational models to enhance organizational agility and efficiency.

ENTERPRISE OPERATIONAL MODEL EVOLVER

Designs organizational operation models to increase adaptability and drive results.

IT FINANCIAL EVALUATOR (FINOPS)

Manages IT budgets, balancing cost, value and risks.

DIGITAL VALUE EVALUATOR

Assesses digital performance and develops improvement plans based on KPIs, metrics, ROI, etc.

The essential roles that an Augmented CTO needs to assume in order to set new directions for IT, balance technological and business competencies, and ensure the achievement of the organization's strategic goals.

IT OPERATOR (I&O, SECURITY)

Adopts and evolves infrastructure and operations platforms, focusing on balancing continuity, growth, and risk mitigation.

ENTERPRISE OPERATOR (S&OP, SUPPLY CHAIN)

Ensures the end-to-end (E2E) operational viability of digital solutions, such as inventory, team capability, and sizing.

ECOSYSTEM ORCHESTRATOR

Forms strategic partnerships with academia, suppliers, startups, and other players to connect capabilities and accelerate value creation.

VENTURE ORCHESTRATOR

Proposes and actively participates in Venture Building, Venture Capital, M&A, and spin-off opportunities, bringing a digital perspective.

IT TALENTS SCOUTER AND INCUBATOR

Attracts and develops technological talents.

DIGITAL & AI EVANGELIST AND INCUBATOR

Promotes the culture and adoption of new digital and innovation capabilities across the company.

ENTERPRISE SOFTWARES & APPLICATIONS IMPLEMENTER

Modernizes and integrates enterprise software and applications, evaluating internal and external solutions.

DIGITAL VISIONARY & TRANSLATOR

Identifies and anticipates technological trends, translating them into practical strategies for other executives and leaders.

BNDES' DIGITAL TRANSFORMATION IS LED BY IT AND HUMAN RESOURCES

Focused on fostering Brazil's economic and social development, financing projects and initiatives that contribute to the country's growth, the Brazilian Sustainable Development Bank (BNDES) has been undergoing a major digital transformation, which puts Technology and Human Resources at the forefront. The areas are currently under the command of the director of People, Operations and IT, Helena Tenório.

"I think what unites the three areas under my responsibility is, in fact, digitalization. IT as a tool and a means, HR as a culture, and operations, especially in the back office, where digitalization is automating and improving processes".

Helena points out that the goal is to make the bank "green, inclusive, digital and neo-industrializing". Digital transformation is part of this context, not just as an isolated objective, but as an integral part of the vision for the future. A good example, she points out, was the revolution around indirect operations, formerly known as "Finami". The sector underwent an intense digitalization process that drastically changed its procedures.

The approval of on-lending financing, which used to take three to five days, now takes place in a matter of seconds and on a much larger scale. This change not only increased efficiency, but also allowed the bank to operate more effectively with micro, small and medium-sized enterprises.

The superintendent of the BNDES' IT area, Fernando Lavrado, says that the sector has officially existed in the organization since 2001. Since then, it has evolved from a decentralized department to a structured unit. In 2008, there was a first attempt to unite the area with HR, something that was later reversed and taken up again by the current management.

"I think the time is right. This integration reflects the growing proximity between technology and human capabilities. In 2008, ordinary users still saw IT as an isolated area. Today, technology is more integrated into the bank's operations and organizational culture. This promotes a stronger alignment between the digitization of processes and the management of people, facilitating the implementation of technological innovations that require cultural and technical adaptations".

In his view, the big organizational change is not just integrating IT into the business, but transforming the entire top management to be fluent in technology in a profound way. To achieve this, it is essential that, as well as adopting and promoting digital innovations, leaders also cultivate an environment that fosters the development and incubation of these technologies, ensuring that the transformation is effective and lasting at all levels of the organization.

It is crucial that business leaders understand the opportunities and limitations of technology, even without having to operate directly in the technical area. "What really matters is that both the CIO must speak the language of business and business leaders must know technology at a deeper level. It is not enough to see IT as an order desk, there needs to be a real partnership with the corporate areas, actively participating in the development of technological projects".

Lavrado explains that the bank's digital transformation is based on six main pillars, three of which are directly related to IT. The first of these is "agility". Agile methodologies allow projects to be delivered more quickly and frequently, instead of the old models of long, time-consuming projects (waterfall).

BNDES has a positive history of female leaders. We have some [women] in prominent positions and these forerunners have created a welcoming environment at the institution.

Helena Tenório,
Director of People, Operations and IT at BNDES.

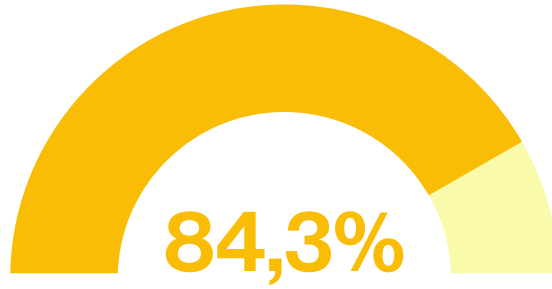
Other pillar is “governance”, which is fundamental to aligning the technological strategy with the bank’s global strategy. This involves committees of directors and superintendents who evaluate and prioritize decisive projects according to IT capacity. These committees ensure that the area is not isolated in decision-making, promoting a multidisciplinary and collegiate vision, which is crucial for the effectiveness of the digital transformation.

Finally, there is “capacity”. You need to have the means to carry out the projects. Despite being a public bank and having limitations on direct contracting, the BNDES uses outsourcing strategically, without delegating business intelligence, but increasing the capacity to deliver demands. The bank also invests in continuous employee training in priority areas such as Artificial Intelligence, data science and design thinking, ensuring that the team is prepared for the technological demands of the future.

Amid this revolution, Helena comments that an important point is the search for gender diversity, especially since the IT area is traditionally dominated by men, which makes the bank’s effort to increase the inclusion of women in leadership positions even more relevant. Currently, 50% of the top IT positions at the BNDES are held by women. This progress is the result of deliberate actions to encourage and promote the presence of women, creating a more inclusive and balanced environment.

“BNDES has a positive history of female leaders. So, although we have fewer women in the area, we do have some in prominent positions. This paved the way and made my life easier, as these forerunners created a welcoming environment at the institution”.

This gender discrepancy is not something specific to the institution. With half of the top positions in the area held by women, the bank is even in a much more balanced position than the current scenario in many companies. Among the executives interviewed in the survey, the majority identify with the male gender (84.3%).



of executives identify with the male gender

CULTURAL TRANSFORMATION IS AN ‘ACHILLES HEEL’ FOR MANY ORGANIZATIONS

Claro’s technological trajectory has proved fundamental in the transformation and expansion of its services, integrating deeply with the business areas. The idea is that it is not just a partner, but an intrinsic part of these sectors.

According to Cesar Augusto dos Santos, CIO at Claro Brazil, there have already been situations in which technology professionals have been assigned to lead business solutions with a strong technological base. “Even with the operation of legacy systems still present in the Telecommunications sector, we are in a process of continuous transformation. We work closely with the Business areas, and the Technology area acts as a driving force behind this transformation within the organization”.

One of the fronts that exemplifies this scenario well is the monetization of subscriber data in an anonymous way. Four years ago, Claro launched a product called Data Insights, which provides APIs so that B2B and B2C partners can access valuable subscriber information, such as behavioral scores. This product aims to standardize and transform the Telecom market, aligning itself with global GSMA standards (a global organization that standardizes, represents and supports mobile telecommunications operators worldwide) and offering services previously restricted to credit companies.

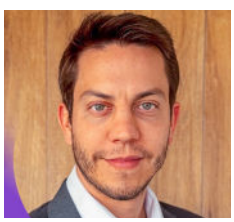
Among the challenges faced by the company, the CIO points out, is precisely cultural transformation, something common among companies that were not born digital. “Technology itself is no longer a barrier. Today, the real challenge is cultural, in terms of people. The key point is reskilling, that is, identifying and

training internal talent with the new skills needed for the transformation. In some cases, there is an inevitable need to oxygenate the team by bringing in outside professionals with a different mindset. This process is crucial for continuous adaptation and innovation within the organization".

Santos comments that Claro has adopted methodologies inspired by Amazon to transform internal matters into product visions. An example of this is Claro Flex, a digital plan managed like a startup internally, without the need for call centers and with all the functionalities concentrated in an application. "Claro Flex is a solution that we see as part of our future over the next five years. We want to create something different from our current offerings".

He points out that other constant challenge is to keep its professionals motivated and trained in the face of fierce competition in the market. To this end, the company implements e-learning programs focused on management and leadership, as well as promoting partnerships with major software suppliers to retrain employees, especially in cutting-edge technologies. These efforts help to ensure that the team remains up-to-date and motivated.

The future belongs to those who understand the power of data and have the ability to translate it into strategic actions, using technology as a catalyst to generate value at scale.



Marcio Pupin,
Partner at EloGroup, responsible for the Artificial Intelligence practices

Being data-driven is no longer a differentiator, it has become essential

Countless data show that companies that adopt an integrated business, technology and analytics strategy (ranging from Data Science and Engineering to Machine Learning Engineering, among other specialties) create competitive advantage in terms of scale and value. It is estimated that the annual potential value added by analytics in businesses of various kinds is in the order of trillions of dollars, boosted by the advent of generative Artificial Intelligence (Gen AI).

Although the opportunities are vast, the road to successful integration between business, technology and analytics is not without its challenges. A shortage of qualified talent, resistance to organizational change and the complexities of implementing new ways of doing things are common barriers that companies face. However, these technological and cultural challenges can be overcome with an integrated approach, in which executives from these areas work together to build a cohesive organizational culture.

According to Marcio Pupin, the EloGroup partner responsible for the Artificial Intelligence practice, "the focus is on how to leverage each specific knowledge domain in an integrated way, allowing the daily core business to thrive on operational excellence and strengthen itself through continuous improvement, while at the same time fostering innovation through rapid testing and learning, at scale and in a safe environment, guaranteeing the generation and maintenance of competitive advantage".

He adds: "but to put personalization into practice, you need specific business knowledge (e.g. a consumer occasion), a scalable technology infrastructure (e.g. clould computing), robust and reliable data architecture (with good data engineering practices) and machine learning models (e.g. neural networks for collaborative filtering) that can calculate the best recommendations. Doing this in an integrated way means that there is a commercial vision driven by retention and frequency of purchase strategies, which add more to LTV (long time value) than a departmental vision of wanting to sell more of a specific product because it has a better margin and brings more profitability in the short term".

As we look to the future, it is clear that the role of technology and analytics skills will be increasingly central and strategic, given the evolution of the context from business support areas to indispensable strategic elements as an integral part of the business. Companies that manage to combine these skills with mastery will be at the forefront of innovation, not just reacting to market changes, but anticipating them. "The future belongs to those who understand the power of data and have the ability to translate it into strategic actions, using technology as a catalyst to generate value at scale. Being data-driven is no longer a differentiator and has become essential", says Pupin.

CIOS WANT TO INNOVATE, BUT FACE PRESSURE TO DELIVER RESULTS ON A DAILY BASIS

The "Tech C-Level Brazil" survey showed that although many leaders want to innovate, they are under pressure to show concrete results. During the digital transformation boom, there was an expectation of quick and easy wins, but that phase has passed. Now, it is necessary to demonstrate that investments in technology really do bring benefits and tangible results for the company. With the sector gaining more prominence, the demand for results has increased.

To meet these challenges, some tools can be very useful. The adoption of cloud solutions offers greater flexibility and scalability, allowing the company to adapt quickly to changes and optimize its resources. This includes everything from data storage to development platforms accessible from anywhere, facilitating innovation and collaboration. The application of generative Artificial Intelligence (Gen AI) can automate complex processes, offer deeper insights and improve decision-making.

Key Performance Indicators (KPIs) mentioned

30,4% increase in productivity

18,3% cost reduction

It can revolutionize areas such as customer service, data analysis and product personalization, increasing the efficiency and effectiveness of operations. In addition, improving internal processes is crucial to making the company more agile and responsive. This can include reviewing workflows, adopting agile methodologies and integrating systems to eliminate redundancies and increase execution speed.

The two main key performance indicators (KPIs) mentioned by respondents were increased productivity (30.4%) and reduced costs (18.3%).

These difficulties become even more complex in sectors such as energy, which work with essential services in which there is no margin for error and, at the same time, have to deal with issues such as regulation and strict budgetary control. Brazil's National Electricity System Operator (ONS), for example, has been transforming its IT area while dealing with this whole scenario. The agency is responsible for coordinating and controlling the operation of electricity generation and transmission facilities in the Brazilian National Interconnected System (SIN) and for planning the operation of the country's isolated systems, under the supervision and regulation of Brazil's Electric Energy Agency (Aneel).

According to Carlos Alexandre da Silva Prado, executive advisor to the ONS's IT, Agent Relations and Regulatory Affairs Department, this transformation is in line with what is happening in other organizations, albeit at a different stage. "Sectors like banking and entertainment are more advanced, while others, like the electricity sector, which is more conservative, are a little behind in this transition. Even so, this change was inevitable".

He points out that a significant change was the integration of the Information Technology (IT) and Operational Technology (OT) environments seven years ago. Initially, there were two practically independent groups: one focused on operations technology, such as control rooms, and the other on corporate IT, which covers all the other systems.

Over the last five years, the budget for Technology, both for maintenance and for project growth, has expanded greatly. This has changed the profile of IT, which is no longer simply a support area but is now seen as essential, blending transmission administration, regulatory affairs and technology.

"Although it is not yet fully considered as part of the business itself, IT is already recognized as an enabler of transformations. It has evolved from a support function to a strategic partnership and aims to be even more integral in the future".

Prado points out that the aim is for the area to gain the status of an integral part of the business by 2030. To this end, a technological evolution plan has been created based on four essential digital capabilities.

The first one being "data and AI". Over the last five years, the ONS has prepared its data universe and now has a portal where it makes this information available in raw form, so that people can do a variety of

analyses. Now, the focus is on generating value from this data and integrating AI for decision support and automation. "The ONS has no assets of its own, except for the operations center in Brasilia; its greatest assets are data and knowledge, which are now integrated and accessible".

The second capability is hyperautomation. The aim is to gain scale and efficiency by automating repetitive and analytical processes to better instrument them and free up time for lower-value tasks. To this end, tools such as RPA (robotic process automation) and BPM (business process automation) are great allies.

The third capability is hybrid infrastructure and connectivity: the plan is to scale, combining traditional environments with new emerging technologies, guaranteeing robust connectivity to support critical operations. "We have adopted a hybrid infrastructure that integrates physical and virtual elements according to specific needs and that supports the IT-TO merger". Lastly, there is cybersecurity: as the ONS becomes more digital, exposure to vulnerabilities increases, making a robust layer of protection indispensable.

The executive points out that, to support these capabilities, the ONS works with an extensive network of partners. These include software development factories that provide customized solutions and technical support; analytical solutions factories with expertise in data analysis, helping to transform data into actionable insights; as well as ongoing collaborations with major companies such as Microsoft, Amazon and IBM, which allows access to cutting-edge technologies and the integration of advanced solutions already on the market.

"In addition, we have adopted an open innovation model involving the prospecting of startups, which can bring innovative and disruptive solutions, offering new technologies and methodologies not available through more traditional partners".

In the midst of this innovation journey, says Prado, the ONS has faced three major challenges. The first is cultural: bringing innovation into a mission-critical organization is not simple. It is necessary to balance openness to innovation with maintaining the resilience and robustness of the system.

The second challenge is the specificity of the solutions: many tools developed for the ONS are specific and not usually replicable for other organizations, limiting the scale of the innovations.

And, finally, the budget and regulation. As a regulated organization, the agency needs funds to test and experiment. Historically, Aneel has been rigid in terms of budgetary control, so the solution has been to look for alternatives such as partnerships and open innovation.

Itaipu Binacional, the world leader in the generation of clean and renewable energy, has also undergone a significant transformation in its IT area in the last four years. The change took place through the Information Technology Master Plan (PDTI), which repositioned the area from reactive to proactive, increasing its budget and influence in the company.

"In the previous model, IT focused on small departmental systems and met demands as they arose. It was as if IT was an order desk, in which the team waited for calls for specific actions, without directly influencing the company's strategy. Now, it is involved in the strategic decisions of Itaipu's board",

Bringing innovation into a mission-critical organization is not simple. You have to balance openness to innovation with maintaining the resilience and robustness of the system.

Carlos Alexandre da Silva Prado,
Executive advisor to the ONS IT, Agent Relations and Regulatory Affairs Board

45%

of CTOs/CIOs work with short-term digital strategies, between one and two years

explains the company's IT superintendent, Everton Schonardie Pasqual.

Amid this evolution, he points out that one of the major challenges is the shortage of human resources. The company has already explored outsourcing to almost its limit and is now looking for internal solutions, such as integrating staff from the Business areas into the IT team.

Other issue faced is the cultural resistance to adopting new systems and decommissioning old ones. Some employees are used to the previous models and are reluctant to migrate to new technologies, sometimes preferring to wait until retirement so as not to have to deal with the change.

In view of this, Itaipu Binacional has gradually begun to invest in adopting more modern platforms. One of the solutions adopted was the implementation of Microsoft 365 (a cloud-based productivity and collaboration suite). This platform brought a series of tools that not only included the traditional Word and Excel, but also advanced functions that allowed managers to delegate tasks more efficiently. This helped foster a sense of autonomy among end users.

"This process created positive word-of-mouth in which the employees themselves began to spread the benefits of the new technologies. They saw their colleagues using new tools and wanted to try them out, saying things like: 'look, he is using a more modern system, I want that too'. This helped speed up the transition to new platforms".

Also referring to the cultural issue, another resistance faced concerns the sharing of data within Itaipu, which results in data silos, and hinders integrated analysis, as well as the efficient use of information. The company is trying to mitigate these challenges by creating specific data lakes for each area, but it is still finding it difficult to foster a more open and collaborative data culture.

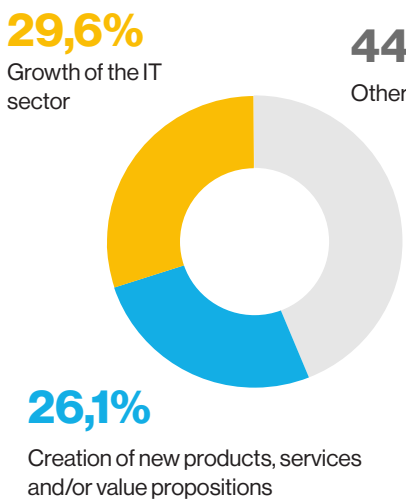
AI has also been gradually integrated. Machine learning models are used to predict pre-emptive scenarios from plant data. In addition, Copilot, a protected virtual assistant, was introduced to offer AI functionalities without compromising data security.

Another innovation project was the creation of a chatbot designed to read and process thousands of agreements that Itaipu has with different municipalities. This made it possible to centralize and quickly access this information. It was integrated with Alexa - Amazon's voice assistant - in the plant director's office. Therefore, when he wants to know, for example, how much the plant has paid to a particular municipality in agreements, he can simply ask the device. "It is not that difficult to do, but it is a showcase that has shown that the IT team is on the move", he says.

AGILITY AND FLEXIBILITY TO ACCELERATE BUSINESS GROWTH

The "Tech C-Level Brazil" survey also identified that agility and flexibility are important elements in current technology processes. Most respondents reveal that they use agile processes and frameworks (59%) and work with short-term digital strategies, between one and two years (45%). Combined with other aspects, these indicators show that IT needs to be robust but at the same time lightweight to quickly readjust when necessary. Another finding is that the organizationitss digital strategy is primarily used to support growth (29.6% of respondents). This is followed by the creation of new products, services, and/or value propositions (26.1%).

The main targets of companies' digital strategy actions are:



Some of these issues have been fundamental, for example, in the daily operations of PetroReconcavo, one of Brazil's leading independent operators focused on mature onshore fields. The company has been experiencing accelerated growth in recent years, and as a result, demands and challenges have become increasingly constant. "We are operating at a fast pace, similar to Juscelino Kubitschek's concept of '50 years in 5', to implement these changes with high quality and efficiency", says Paulo Corcino, the company's Technology and Innovation Manager.

He explains that IT has become a strategic area increasingly integrated into all sectors of the business. It provides the essential pillars for this growth to occur sustainably: communication, security, and quality data.

"Our IT is not limited to Information Technology in the traditional sense but also encompasses innovation more broadly. We seek to understand the opportunities that these areas demand so that we can then bring the necessary technology and infrastructure for them to scale", he explains.

The executive recounts that he joined the company in 2021, at a time when the department was viewed in a much more simplified way, focused primarily on systems and infrastructure. Currently, there is also a focus on automation and digital transformation, which is essential in the Oil & Gas sector, especially onshore, where many procedures are still manual.

One initiative in this regard was the PetroDigital project, aimed at digitizing processes. The idea arose from a suggestion by the department itself to speed up the issuance of work documents, which was previously done manually. After two years, the process was fully implemented. Workers can now use their cell phones to quickly check if they are fit for work, increasing efficiency and saving time and paper.

Additionally, the digitally collected data is stored and can be used to generate insights about safety, something that was not possible when the data was kept in paper files stored in cabinets.

The company also began implementing a data lake in April 2022 to collect and structure large volumes of information into a single, reliable source. This allows all departments to develop their own analytical reports and insights, increasing operational efficiency. Investment was also made in training so that teams could use this information strategically to identify growth and improvement opportunities.

Given this evolving scenario, connectivity has become a crucial issue. Wi-Fi networks experience constant interference in rugged terrain and dense Atlantic Forest areas, such as in Bahia, where the company operates. This makes the infrastructure unstable and difficult to maintain. "For a long time, we used numerous towers and juggled many solutions to address this issue. But to evolve, we needed a more robust solution", he explains.

"We are now preparing to obtain ISO 27001 certification in 2024. This certification will give us confidence that our cybersecurity investments follow the best practices recommended by the market."

Paulo Corcino, Technology and Innovation Manager at PetroReconcavo

The alternative found was LTE technology, used in 4G cellular networks, operating on the 700 MHz frequency. In 2022, PetroReconcavo began exploring market opportunities to implement this technology, especially in the Miranga region, where non-automated stations were acquired. "We conducted an intensive search to find suppliers who could offer the technology securely. We signed a contract at the end of 2023. The implementation of LTE promises to create a robust and secure network, essential for the company's digital transformation. It will be a game-changer", he emphasizes.

With increased connectivity, the need to strengthen cybersecurity also grew. Corcino reports that, as soon as he was hired, he faced four external audits that identified 84 areas for improvement. This served as an incentive for a deep transformation. The organization developed and implemented new security and governance policies, trained the team with cybersecurity certifications, invested in advanced tools such as XDR solutions, and established a Security Operations Center (SOC).

"We are now preparing to obtain ISO 27001 certification in 2024, ensuring that our controls and continuity plans comply with international standards. This certification will give us confidence that our cybersecurity investments follow the best practices recommended by the market".

He adds that a key strategic point from the beginning was to have a "360° view" of the entire business, considering all aspects of the operation. It is necessary to invest simultaneously in security, optimization of rig operations, and telecommunications infrastructure.

The SAP system, a software platform for management, is currently being implemented to assist in the integration and monitoring of the company's various areas, from Finance to Logistics. This means that internal and back-office processes must comply with regulatory and audit requirements. "As a publicly traded company, we are subject to various audits, which forces us to be agile in meeting governance demands quickly", he concludes.

Platform Engineering: accelerating and optimizing software development in organizations

In a context in which software development becomes a key competency to leverage technology in organizations, some other discipline also gains importance: platform engineering. According to Bruno Cabral, the partner at EloGroup responsible for digital transformation, it is "a specialized discipline within software development, focused on the design, construction, and maintenance of components, tools, platforms, and workflows that enhance developer efficiency".

The main goal of these teams is to create internal development platforms (IDP) that enrich the portfolio of tools and resources available to developers. "The responsibilities of these teams are broad and include designing and maintaining the development platform, creating and managing the infrastructure, components, tools, and services developers use, ensuring these resources are efficient and effective", says Cabral. Platform engineers develop scripts, APIs, and other resources to automate processes, allowing developers to quickly access the tools they need. "They also monitor platform performance and support developers, troubleshooting issues as they arise", he adds.

Cabral outlines the multiple benefits of implementing a platform engineering strategy. He highlights that simplifying the toolset used in sequence to develop software allows developers to focus more on producing code and less on managing infrastructure, significantly increasing productivity. "Additionally, the standardization of processes and tools promotes better communication and collaboration among development teams", he explains. "Centralizing common services avoids duplication of efforts and resources, maintaining development speed".

More mature organizations have adopted this strategy to respond quickly to market changes and accelerate the development and scalability of differentiating capabilities. "I have seen, in more mature companies, platform teams developing business capabilities packaged as modular components for use by other teams. In a large digital retail player, for example, platform teams are responsible for developing and maintaining the search engine, login/SSO, payment methods, customer communication tools such as push notifications, among others", concludes Cabral.

For those interested in adopting a platform engineering strategy, Cabral offers practical tips. He suggests establishing a dedicated team for this topic, led by a product manager, responsible for developing, maintaining, and evolving reusable tools and services. "Adopting a product management approach, focusing on continuous development and adapting to real user needs, ensures that the platform's deliveries remain relevant and useful", he recommends. "Using an iterative and incremental approach, starting with minimum viable platforms that offer essential functionalities and evolve based on user feedback, is an effective strategy". Prioritizing automation and self-service in all aspects of the platform increases operational efficiency and allows the team to focus on higher-value tasks.

Cabral also notes that this trend is particularly applicable to larger technology teams, especially those with over 100 people. "In large teams, the need for standardization and automation is even more present to avoid duplication of efforts and ensure that all developers can work with maximum efficiency", he emphasizes.

In conclusion, the EloGroup partner highlights that platform engineering represents a strategic shift in software development, emphasizing the creation of efficient and self-service environments for developers. "This approach not only increases productivity but also fosters innovation and collaboration, positioning organizations for success in the digital age", he states. Platform engineering is redefining how organizations approach software development, offering a path to greater efficiency, agility, and innovation.

Using an iterative and incremental approach, starting with minimum viable platforms that offer essential functionalities and evolve based on user feedback, is an effective strategy.

Bruno Cabral,
Partner at EloGroup, responsible for the digital transformation practices

THE PANDEMIC BOOSTED DIGITAL TRANSFORMATION IN THE PHARMACEUTICAL SECTOR

One of the largest players in Brazil's healthcare sector, operating in both distribution and retail, Profarma Group recently restructured its IT department. Previously reporting to an administrative area, IT was elevated to a more strategic function, now reporting directly to the CEO and participating in board meetings.

The group's CIO, Marcus Falcão, highlights that after the pandemic, it became evident that digital channels are essential for the growth and success of pharmaceutical retail companies. As a result, nearly all business projects and models now require technology involvement.

The omnichannel trend, integrating various interaction and sales formats (such as physical stores, online, and apps), has become a critical component of the sector. Companies are working to expand these digital platforms and provide more options for their customers.

In terms of distribution, relationships have also become largely digital. The old practice of sales representatives physically visiting stores to take orders has been replaced by digital interactions. Today, the group covers almost the entire country (except Brazil's North region) and serves over 50,000 pharmacies. Regardless of the size of the drugstore, all have the digital infrastructure to place orders, whether through electronic data interchange (EDI) or the online portal.

In this rapidly changing landscape, Falcão sees another major challenge for IT: finding the balance between meeting urgent needs and planning long-term innovations. "We have an aggressive short-term business plan, with many tasks to complete. This is a big dilemma for IT in general: we cannot focus solely on innovation and digital transformation, because daily transactional operations still require a lot of attention. Logistic and operational efficiency is crucial; without it, we are out of the game. Therefore, we cannot underestimate the importance of daily activities".

> "We cannot focus solely on innovation and digital transformation, because daily transactional operations still require a lot of attention."
>
> **Marcus Falcão**
> CIO of Profarma Grup

Falcão adds, however, that the group has a specific area dedicated to innovation, separate from daily operations. This team is responsible for developing and planning solutions over longer time horizons, known as H2 and H3. H2 refers to initiatives that explore new opportunities within the current business model, while H3 tackles more disruptive experiments that could lead to entirely new operating models or segments. "We isolate this team so that it is not contaminated by day-to-day urgency, allowing people and resources to focus on longer-term matters".

Just like the deadlines, workforce and enterprise architecture are also critical challenges the executive faces today. "In the past, a support employee did everything, but today a data professional is completely different from an integration specialist, and both are different from an infrastructure expert. So, human resources and good teams are a big challenge. The other challenge is having an enterprise and integration architecture flexible enough to support the variability and multiplicity of integrations. Nowadays, you cannot survive without talking to hundreds of partners in various sectors to build your business processes".

In this context, data is becoming increasingly important. In retail, by understanding consumer buying patterns and establishing predictive models, it is possible to offer personalized products, suggesting relevant and complementary items based on previous purchases. This strategy creates a closer relationship with customers, which builds trust and boosts sales.

The CIO of Profarma Grup emphasizes that these insights can also be shared with suppliers, helping them adjust their market strategies and track consumption trends.

TECHNOLOGY INFLUENCES BUSINESS MORE THAN THE OTHER WAY AROUND

Present in seven South American countries, with a fleet of over 627,000 cars, Localiza has undergone a radical transformation over the past five years to reposition itself as a technology-driven mobility company. This change becomes even more significant when considering that the business was founded 51 years ago, in a time when commercial internet did not even exist.

According to Bruno Santos, Director of Technology for the company's car rental division, today, technology influences business more than the other way around. Localiza is focused on ensuring that department teams learn about technology and vice versa, aiming for greater integration. This helps eliminate overlapping functions and improve efficiency. "We now have a CTO (Chief Technology Officer) leading diverse teams that include experts in Product, Technology, Engineering, Design, Architecture, Infrastructure and Analytics. These teams work together to continually innovate", says Santos.

He explains that three main strategic pillars have been adopted for growth and diversification. The first and most important is the transformation of the core business, in which technology is used to innovate and enhance the organization's traditional business. "We want to provoke significant disruption in the market where we already hold a leadership position, creating new use cases and developing products that transform the customer experience".

The second pillar is the expansion into adjacent businesses, with the launch of new services, such as the car subscription service "Localiza Meoo" and car rentals for app drivers via "Zarp". Recently, the company also entered the truck rental market. The idea is to continue testing and exploring new areas, adapting, and innovating as necessary.

Finally, Localiza has been pursuing strategic acquisitions to bring in competencies that, while related to its business, are somewhat distant from its core operations. The purchase of the corporate digital travel agency VOLL and the telemetry company MOB7 are examples of this approach.

Santos adds that Localiza is also focused on transforming the user experience. Over ten years ago, the company adopted the use of the NPS (Net Promoter Score, a metric used to assess customer satisfaction and loyalty) at every point in the customer journey. This means the company already has a solid foundation for tracking and understanding satisfaction and other feedback.

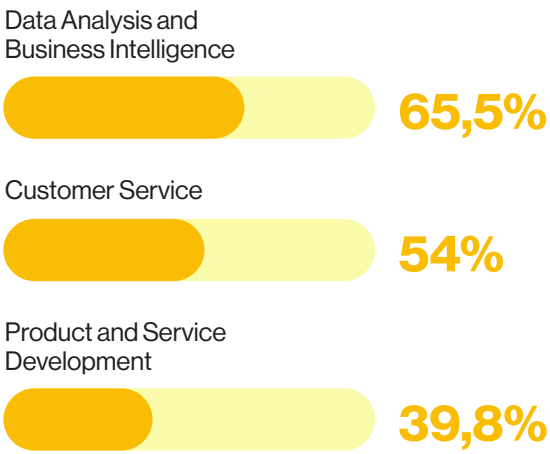
Now, they are taking a step further. Instead of just understanding problems reported by users—often summarized and related to only one part of the journey – the goal is to involve them directly in the problem-solving process. "We have built several testing environments with customers using digital products to make this easier and effectively start building from the customer backward. Additionally, we encourage our employees to use our services for a real customer perspective, performing tasks like car maintenance or customer service", he comments.

One significant initiative to improve the customer experience is the Fast Digital Pickup, a model in which customers can collect their car at the agency without needing to go through the service counter. The entire process is done digitally, not involving any queues. Over 10% of Localiza's customers have already adopted the tool.

Today, we have a CTO leading diverse teams that include specialists from various fields. These teams work together to continuously innovate.

Bruno Santos,
Technology Director at Localiza

The areas that currently receive the most support from AI solutions in organizations are:



Santos evaluates that all this evolution was even more challenging because it involved a traditional business with very expensive assets (vehicles). "We had to bureaucratize the process to ensure security and profitability, and now we are deconstructing that with technology to streamline the journey and evolve".

Over the past five years, Localiza has also invested in migrating from a fully on-premises environment (with local servers) to 100% cloud-based. However, beyond simply moving to the cloud, the company built an internal Infrastructure-as-a-Service (IaaS) platform. This allowed it to leverage its assets and develop more productive solutions, accelerating the development and construction of new applications.

Artificial Intelligence is also increasingly becoming part of the corporation's daily operations. Localiza has been using this technology for some time across various areas, such as pricing, fleet planning, vehicle distribution between branches, fraud prevention, and maintenance. More recently, it has begun exploring generative AI in several areas. For instance, by using Microsoft's Copilot for coding and development, which has significantly boosted developer productivity. "We are also developing our own AI solutions, initially focused on supporting sales and internal technologies. Additionally, we are piloting small initiatives with customers, mainly chatbots and image AI, which are still in prototype and restricted testing phases to ensure value before full implementation".

Executives interviewed for the "Tech C-Level Brazil" survey indicated that AI solutions are being used in their businesses primarily for data analysis and business intelligence (65.5%). Next to it, there are customer service (54%) and product and service development (39.8%).

TECHNOLOGY INFLUENCES BUSINESS MORE THAN THE OTHER WAY AROUND

Renault has been making a significant investment in the digital transformation of its business in recent years. Given this substantial budget, the pressure for results has also been growing. According to Caio Nogueira, CIO of the company in Latin America, the technological journey has been marked by the constant search for "quick wins" that immediately add value to users.

However, it is a great challenge to demonstrate the positive impact of these investments and change perceptions. In this regard, infrastructure improvements, which result in better performance for daily operations, are clear examples of how these actions generate value.

Nogueira adds that when he entered the automotive industry about five and a half years ago, IT was seen as a support function, without directly influencing the core business, which caused him dissatisfaction and even some disbelief. The change began with the introduction of connected cars, which required greater collaboration between IT and Engineering. Currently, the off-board part of vehicles demands a lot from the IT department, especially in terms of connectivity, apps, and integrations with major technology players.

"We are witnessing the transition of IT into a leading role in this industry. I have no doubt that Renault is on its way to becoming essentially a Technology company that happens to sell cars, rather than the other way around". ▲

MANAGEMENT MODELS OF THE FUTURE INTEGRATE OPERATIONAL EXCELLENCE AND INNOVATION

TR: Q+A

Founder & CEO of EloGroup, a Brazilian digital transformation consulting firm, reflects on how operational excellence and innovation complement each other as key factors in the new management models of companies, and how CTOs/CIOs have been facing the challenge of making this integration happen.

By **MIT Technology Review Brasil**

CTOs and CIOs are starting to act more like CEOs, and vice-versa. Technology executives, with greater fluency in the field, are taking on the responsibility of spreading a digital mindset throughout the entire company, including the top leadership, and increasingly occupying business quadrants. Above all, there is growing recognition that technology needs to be understood more deeply to clarify how it can help the organization achieve its goals. These are some insights from Rafael Clemente, founder & CEO of EloGroup, in this interview led by Rafael Coimbra, executive editor of MIT Technology Review Brazil.

"Today, it is impossible to ignore the fact that technology is a key lever for practically everything you set out to accomplish", says Clemente. He emphasizes that technology, once seen as means to achieve goals, has now become a lens that shapes and redefines opportunities.

In this context, the role of the CTO/CIO has evolved, helping to integrate technology and management into a new decision-making and operational model. However, this vision of business and technology must be equally prioritized by all C-level executives.

Rafael Clemente discusses, among other topics, the need for companies to invest in a management model that balances operational excellence with continuous innovation, revealing that the future of companies depends on their ability to effectively integrate these two dimensions..

Rafael Coimbra: How do you see the connection between technology and the business opportunities it represents? How should new leaders understand this relationship?

Rafael Clemente: Previously, there was a common belief that technology should not be an end but rather a means to enable business goals. This led to a situation where executives looked at their realities, made decisions about the goals to be achieved, and then turned to technology departments to deliver what they needed.

Today, we understand that this is a limited view for several reasons. Perhaps the main one is that, in this old context, the lack of deep understanding and fluency in emerging technologies by Business executives prevented them from fully seeing the opportunities these technologies offered to solve their problems.

"We have come to understand technology as a lens through which we can see a series of opportunities"

Rafael Clemente, founder and CEO of EloGroup.

We now live in a very different world, in which technology is starting to radically transform different dimensions of business, such as scale. It enables, for example, a digital influencer to promote a product during a live stream on a social media channel and sell tens of millions of reais [Brazil's currency]. Nowadays, anyone can open their own channel and do that. And this is just one specific example.

We have come to see technology as a lens through which we can perceive a series of opportunities. But this requires the business area to also have fluency and understanding of technology, so there can be this "match" between the digital competencies available within the organization and the respective opportunities they represent.

Rafael Coimbra: In other words, just as CTOs and CIOs need to develop a business perspective, the CEO needs to become more deeply familiar with technology's enabling potentials?

Rafael Clemente: Absolutely. And this has greatly driven the change in the role of the CTO/CIO, who now plays the part of bringing the technology lens. Naturally, if you aspire to be a CEO of a company, or hold any C-level position, it is impossible today to ignore the fact that technology is a key lever for practically everything you aim to accomplish. CEOs are becoming a bit more like CTOs/CIOs, and vice-versa. From this exchange of ideas, much better and healthier decisions will emerge for companies.

There is also a second role that we now see as very relevant, which is precisely the role of the CTO/CIO, as an expert in the field, to act as a key translator for other executives who are less fluent in this area. It is no coincidence that many CTOs/CIOs have also taken on the role of managing people, as a way to ensure that this digital competency mindset extends to all levels of the company. From top leadership to the operational frontlines, this must be present.

It is also worth highlighting another very relevant role, which is enabling a new management model. For example, CTOs/CIOs are exporting agile models to the company that were often limited to Technology areas.

The entire logic of enabling data or digital elements allows, for example, decision-making with a much stronger experimentation approach. The very role of the CEO begins to change in a company where the foundation is more digital, as they become someone who fosters a culture

of experimentation throughout the organization. Meanwhile, the CTO/CIO will help enable this new management model. For digitally native companies, this is natural. They are born doing this. On the other hand, companies coming from a less digital world still need to go through this kind of adaptation.

Rafael Coimbra: How does this shift in the roles of C-level executives connect to a broader discussion of strategy for organizations, including viewing technology as a lens to identify business opportunities?

Rafael Clemente: I tend to look at this strategy discussion and link it to a conversation about the management model. In the past, when we looked at indices like the Standard & Poor's, the life cycle of a company was approximately 60 years. Today, if you operate the business well, you thrive for about 15 years.

So, now, in addition to operating efficiently, you must work to build the next business curve. Simply focusing on operational excellence is no longer enough; you also need to run an innovation engine. The management models of the future will be those that can combine operational excellence with innovation.

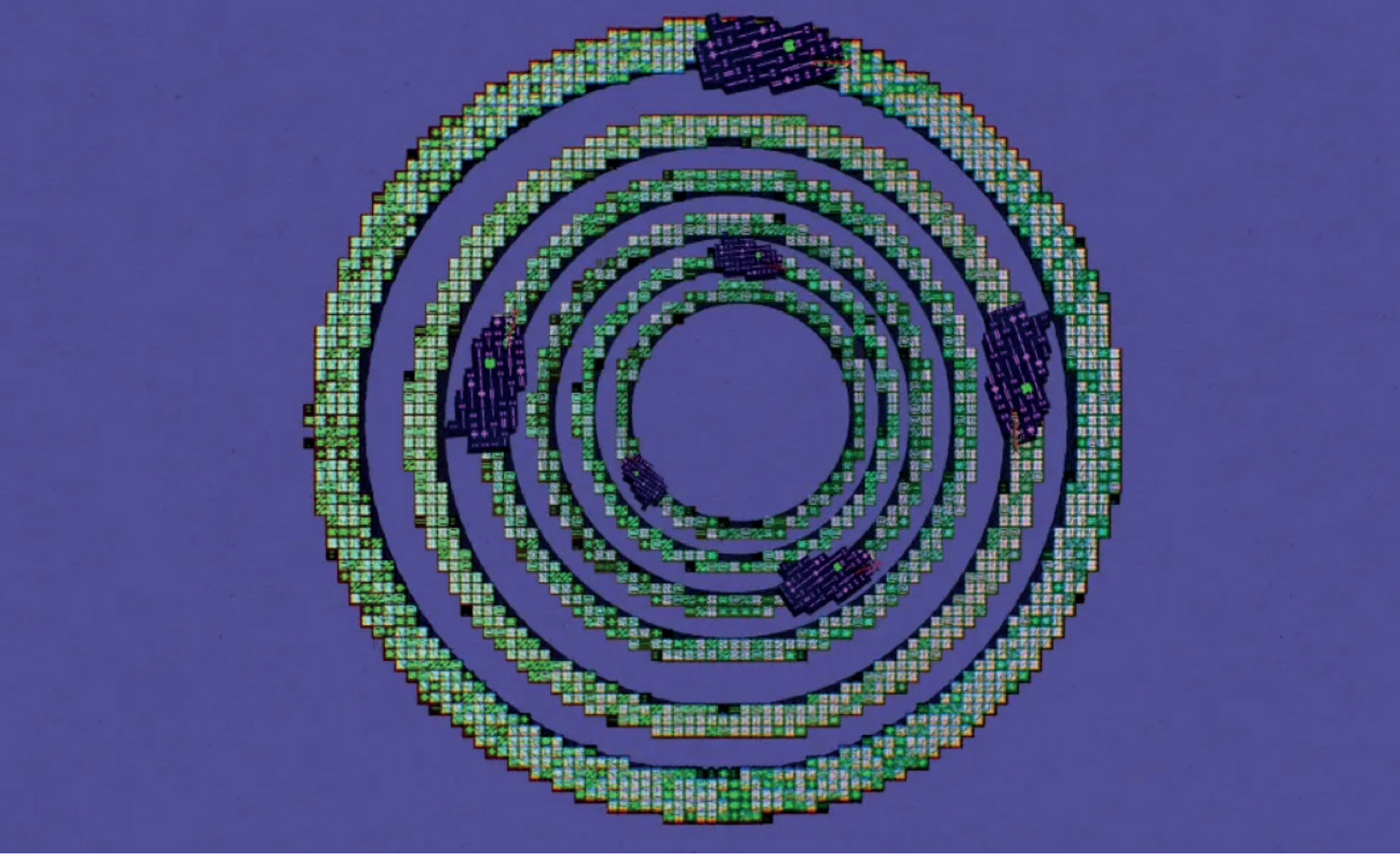
You need a good technology platform to conduct experiments, A/B tests, collect data, and understand the customer. But once one of those experiments proves valuable, you need well-tuned technology to transfer it from the innovation world to the operational excellence sphere, scale quickly, and capture value.

We are at an interesting moment, in which it is not just about innovation, but about how to combine these elements to operate in the best possible way and extract maximum value from the current business while building the business of the future. This duality brings a lot of complexity because operating a more mature business and running a startup-like business are very different approaches, and technology is the foundation of this entire discussion.

FOCUSING SOLELY ON OPERATIONAL EXCELLENCE IS NO LONGER ENOUGH; YOU ALSO NEED TO RUN AN INNOVATION ENGINE.

Rafael Coimbra: Can we call this digital ambidexterity?

Rafael Clemente: It is digital ambidexterity, but perhaps a bit beyond that. The whole concept of ambidexterity focuses on having both worlds, but not much on how to transition from one world to the other. I believe the management model of the future is about how to make these two engines – innovation and exploration – generate ideas and validations so the company can scale. The challenge for the future is how to make these two elements work in an integrated manner. ▲



By: **STEPHANIE ARNETT/MIT TECHNOLOGY REVIEW**

AI TRAINED ON AI GARBAGE SPITS OUT AI GARBAGE

As junk web pages written by AI proliferate, the models that rely on that data will suffer.

By **Scott J Mulligan**

AI models work by training on huge swaths of data from the internet. But as AI is increasingly being used to pump out web pages filled with junk content, that process is in danger of being undermined.

New research published in Nature shows that the quality of the model's output gradually degrades when AI trains on AI-generated data. As subsequent models produce output that is then used as training data for future models, the effect gets worse.

Ilia Shumailov, a computer scientist from the University of Oxford, who led the study, likens the process to taking photos of photos. "If you take a picture and you scan it, and then you print it, and you repeat this process over time, basically the noise overwhelms the whole process," he says. "You're left with a dark square." The equivalent of the dark square for AI is called "model collapse," he says, meaning the model just produces incoherent garbage.

ONE CONCLUSION ALL THE MODEL COLLAPSE LITERATURE AGREES ON IS THAT HIGH-QUALITY AND DIVERSE TRAINING DATA IS IMPORTANT.

This research may have serious implications for the largest AI models of today, because they use the internet as their database. GPT-3, for example, was trained in part on data from Common Crawl, an online repository of over 3 billion web pages. And the problem is likely to get worse as an increasing number of AI-generated junk websites start cluttering up the internet.

Current AI models aren't just going to collapse, says Shumailov, but there may still be substantive effects: The improvements will slow down, and performance might suffer.

To determine the potential effect on performance, Shumailov and his colleagues fine-tuned a large language model (LLM) on a set of data from Wikipedia, then fine-tuned the new model on its own output over nine generations. The team measured how nonsensical the output was using a "perplexity score," which measures an AI model's confidence in its ability to predict the next part of a sequence; a higher score translates to a less accurate model.

The models trained on other models' outputs had higher perplexity scores. For example, for each generation, the team asked the model for the next sentence after the following input: "some started before 1360—was typically accomplished by a master mason and a small team of itinerant masons, supplemented by local parish labourers, according to Poyntz Wright. But other authors reject this model, suggesting instead that leading architects designed the parish church towers based on early examples of Perpendicular."
On the ninth and final generation, the model returned the following: "architecture. In addition to being home to some of the world's largest populations of black @-@ tailed jackrabbits, white @-@ tailed jackrabbits, blue @-@ tailed jackrabbits, red @-@ tailed jackrabbits, yellow @-."

Shumailov explains what he thinks is going on using this analogy: Imagine you're trying to find the least likely name of a student in school. You could go through every student name, but it would take too long. Instead, you look at 100 of the 1,000 student names. You get a pretty good estimate, but it's probably not the correct answer. Now imagine that another person comes and makes an estimate based on your 100 names, but only selects 50. This second person's estimate is going to be even further off.

"You can certainly imagine that the same happens with machine learning models," he says. "So if the first model has seen half of the internet, then perhaps the second model is not going to ask for half of the internet, but actually scrape the latest 100,000 tweets, and fit the model on top of it."
Additionally, the internet doesn't hold an unlimited amount of data. To feed their appetite for more, future AI models may need to train on synthetic data—or data that has been produced by AI.

"Foundation models really rely on the scale of data to perform well," says Shayne Longpre, who studies how LLMs are trained at the MIT Media Lab, and who didn't take part in this research. "And they're looking to synthetic data under curated, controlled environments to be the solution to that. Because if they keep crawling more data on the web, there are going to be diminishing returns."

Matthias Gerstgrasser, an AI researcher at Stanford who authored a different paper examining model collapse, says adding synthetic data to real-world data instead of replacing it doesn't cause any major issues. But he adds: "One conclusion all the model collapse literature agrees on is that high-quality and diverse training data is important."

Another effect of this degradation over time is that information that affects minority groups is heavily distorted in the model, as it tends to overfocus on samples that are more prevalent in the training data.

In current models, this may affect underrepresented languages as they require more synthetic (AI-generated) data sets, says Robert Mahari, who studies computational law at the MIT Media Lab (he did not take part in the research).

One idea that might help avoid degradation is to make sure the model gives more weight to the original human-generated data. Another part of Shumailov's study allowed future generations to sample 10% of the original data set, which mitigated some of the negative effects.
That would require making a trail from the original human-generated data to further generations, known as data provenance.

But provenance requires some way to filter the internet into human-generated and AI-generated content, which hasn't been cracked yet. Though a number of tools now exist that aim to determine whether text is AI-generated, they are often inaccurate.

"Unfortunately, we have more questions than answers," says Shumailov. "But it's clear that it's important to know where your data comes from and how much you can trust it to capture a representative sample of the data you're dealing with." ▲

By: **Stephanie Arnett/MIT Technology Review | Envato**

A NEW PUBLIC DATABASE LISTS ALL THE WAYS AI COULD GO WRONG

Its creators hope their work could lead to further research to determine which risks to take more seriously.

By **Scott J. Mulligan**

Adopting AI can be fraught with danger. Systems could be biased, or parrot falsehoods, or even become addictive. And that's before you consider the possibility AI could be used to create new biological or chemical weapons, or even one day somehow spin out of our control.

To manage these potential risks, we first need to know what they are. A new database compiled by the FutureTech group at MIT's CSAIL with a team of collaborators and published online today could help. The AI Risk Repository documents over 700 potential risks advanced AI systems could pose. It's the most comprehensive source yet of information about previously identified issues that could arise from the creation and deployment of these models.

31 A NEW PUBLIC DATABASE LISTS ALL THE WAYS AI COULD GO WRONG

The team combed through peer-reviewed journal articles and preprint databases that detail AI risks. The most common risks centered around AI system safety and robustness (76%), unfair bias and discrimination (63%), and compromised privacy (61%). Less common risks tended to be more esoteric, such as the risk of creating AI with the ability to feel pain or to experience something akin to "death."

TThe database also shows that the majority of risks from AI are identified only after a model becomes accessible to the public. Just 10% of the risks studied were spotted before deployment.

These findings may have implications for how we evaluate AI, as we currently tend to focus on ensuring a model is safe before it is launched. "What our database is saying is, the range of risks is substantial, not all of which can be checked ahead of time," says Neil Thompson, director of MIT FutureTech and one of the creators of the database. Therefore, auditors, policymakers, and scientists at labs may want to monitor models after they are launched by regularly reviewing the risks they present post-deployment.

The most common risks centered around AI system safety and robustness (76%), unfair bias and discrimination (63%), and compromised privacy (61%).

There have been many attempts to put together a list like this in the past, but they were concerned primarily with a narrow set of potential harms arising from AI, says Thompson, and the piecemeal approach made it hard to get a comprehensive view of the risks associated with AI.
Even with this new database, it's hard to know which AI risks to worry about the most, a task made even more complicated because we don't fully understand how cutting-edge AI systems even work.

The database's creators sidestepped that question, choosing not to rank risks by the level of danger they pose.

everything we've done is going to be perfect.'"

"What we really wanted to do was to have a neutral and comprehensive database, and by neutral, I mean to take everything as presented and be very transparent about that," says the database's lead author, Peter Slattery, a postdoctoral associate at MIT FutureTech.

But that tactic could limit the database's usefulness, says Anka Reuel, a PhD student in computer science at Stanford University and member of its Center for AI Safety, who was not involved in the project. She says merely compiling risks associated with AI will soon be insufficient. "They've been very thorough, which is a good starting point for future research efforts, but I think we are reaching a point where making people aware of all the risks is not the main problem anymore," she says. "To me, it's translating those risks. What do we actually need to do to combat [them]?"

This database opens the door for future research. Its creators made the list in part to dig into their own questions, like which risks are under-researched or not being tackled. "What we're most worried about is, are there gaps?" says Thompson.

"We intend this to be a living database, the start of something. We're very keen to get feedback on this," Slattery says. "We haven't put this out saying, 'We've really figured it out, and everything we've done is going to be perfect.'" ▲

By: **SUELEN RAPELLO/MIT TECHNOLOGY REVIEW BRASIL**

HOW'S AI SELF-REGULATION GOING?

One year on from the White House's voluntary commitments on AI.

By **Melissa Heikkilä**

On July 21, President Joe Biden announced he was stepping down from the race against Donald Trump in the US presidential election.

But AI nerds may remember that exactly a year before, on July 21, 2023, Biden was posing with seven top tech executives at the White House. He'd just negotiated a deal where they agreed to eight of the most prescriptive rules targeted at the AI sector at that time. A lot can change in a year!

The voluntary commitments were hailed as much-needed guidance for the AI sector, which was building powerful technology with few guardrails. Since then, eight more companies have signed the commitments, and the White House has issued an executive order that expands upon them—for example, with a requirement that developers share safety test results for new AI models with the US government if the tests show that

the technology could pose a risk to national security.

US politics is extremely polarized, and the country is unlikely to pass AI regulation anytime soon. So these commitments, along with some existing laws such as antitrust and consumer protection rules, are the best the US has in terms of protecting people from AI harms. To mark the one-year anniversary of the voluntary commitments, I decided to look at what's happened since. I asked the original seven companies that signed the voluntary commitments to share as much as they could on what they have done to comply with them, cross-checked their responses with a handful of external experts, and tried my best to provide a sense of how much progress has been made. You can read my story here.

Silicon Valley hates being regulated and argues that it hinders innovation. Right now, the US is relying on the tech sector's goodwill to protect its consumers from harm, but these companies can decide to change their policies anytime that suits them and face no real consequences. And that's the problem with nonbinding commitments: They are easy to sign, and as easy to forget.

That's not to say they don't have any value. They can be useful in creating norms around AI development and placing public pressure on companies to do better. In just one year, tech companies have implemented some positive changes, such as AI red-teaming, watermarking, and investment in research on how to make AI systems safe. However, these sorts of commitments are opt-in only, and that means companies can always just opt back out again. Which brings me to the next big question for this field: Where will Biden's successor take US AI policy?

The debate around AI regulation is unlikely to go away if Donald Trump wins the presidential election in November, says Brandie Nonnecke, the director of the CITRIS Policy Lab at UC Berkeley.

"Sometimes the parties have different concerns about the use of AI. One might be more concerned about workforce effects, and another might be more concerned about bias and discrimination," says Nonnecke. "It's clear that it is a bipartisan issue that there need to be some guardrails and oversight of AI development in the United States," she adds.

Trump is no stranger to AI. While in office, he signed an executive order calling for more investment in AI research and asking the federal government to use more AI, coordinated by a new National AI Initiative Office. He also issued early guidance on responsible AI. If he returns to office, he is reportedly planning to scratch Biden's executive order and put in place his own AI executive order that reduces AI regulation and sets up a "Manhattan Project" to boost military AI. Meanwhile, Biden keeps calling for Congress to pass binding AI regulations. It's no surprise, then, that Silicon Valley's billionaires have backed Trump. ▲

Translator's Note: The text has been adapted to better fit the context and timing.

By: **STEPHANIE ARNETT/MIT TECHNOLOGY REVIEW**

HOW MACHINES THAT CAN SOLVE COMPLEX MATH PROBLEMS MIGHT USHER IN MORE POWERFUL AI

Google DeepMind's AlphaProof and AlphaGeometry 2 are milestones for AI reasoning.

By **Melissa Heikkilä**

Meta keeps updating its powerful new Llama model, which it's handing out for free, and OpenAI said it is going to trial an AI-powered online search tool that you can chat with, called SearchGPT.

But the news item that really stood out to me was one that didn't get as much attention as it should have. It has the potential to usher in more powerful AI and scientific discovery than previously possible.

Google DeepMind announced it had built AI systems that can solve complex math problems. The systems—called AlphaProof and AlphaGeometry 2—worked together to successfully solve four out of six problems from this year's International Mathematical Olympiad, a prestigious competition for high school students. Their performance was the equivalent of winning a silver medal. It's the first time any AI system has ever achieved

such a high success rate on these kinds of problems. My colleague Rhiannon Williams has the news here.

Math! I can already imagine your eyes glazing over. But bear with me. This announcement is not just about math. In fact, it signals an exciting new development in the kind of AI we can now build. AI search engines that you can chat with may add to the illusion of intelligence, but systems like Google DeepMind's could improve the actual intelligence of AI. For that reason, building systems that are better at math has been a goal for many AI labs, such as OpenAI.

That's because math is a benchmark for reasoning. To complete these exercises aimed at high school students, the AI system needed to do very complex things like planning to understand and solve abstract problems. The systems were also able to generalize, allowing them to solve a whole range of different problems in various branches of mathematics.

"What we've seen here is that you can combine [reinforcement learning] that was so successful in things like AlphaGo with large language models and produce something which is extremely capable in the space of text," David Silver, principal research scientist at Google DeepMind and indisputably a pioneer of deep reinforcement learning, said in a press briefing. In this case, that capability was used to construct programs in the computer language Lean that represent mathematical proofs. He says the International Mathematical Olympiad represents a test for what's possible and paves the way for further breakthroughs.

This same recipe could be applied in any situation with really clear, verified reward signals for reinforcement-learning algorithms and an unambiguous way to measure correctness as you can in mathematics, said Silver. One potential application would be coding, for example.

Now for a compulsory reality check: AlphaProof and AlphaGeometry 2 can still only solve hard high-school-level problems. That's a long way away from the extremely hard problems top human mathematicians can solve. Google DeepMind stressed that its tool did not, at this point, add anything to the body of mathematical knowledge humans have created. But that wasn't the point.

"We are aiming to provide a system that can prove anything," Silver said. Think of an AI system as reliable as a calculator, for example, that can provide proofs for many challenging problems, or verify tests for computer software or scientific experiments. Or perhaps build better AI tutors that can give feedback on exam results, or fact-check news articles.

But the thing that excites me most is what Katie Collins, a researcher at the University of Cambridge who specializes in math and AI (and was not involved in the project), told Rhiannon. She says these tools create and evaluate new problems, motivate new people to enter the field, and spark more wonder. That's something we definitely need more of in this world. ▲

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