INDUSTRIAL
DIGITAL TRANSFORMATION
TOP 25 FOR 2022

ARC Special Report
January 2023

ARC Advisory Group's second annual industrial digital transformation top 25 report highlights companies that are succeeding at integrating digital technology into all areas of business, fundamentally changing the way they operate and deliver value to their customers.

Digital transformation leaders, across many different industries, share common traits and visions, helping them overcome complex challenges to innovate and stay agile. Industrial innovation continues to accelerate, and leading companies have their transformation initiatives well underway. For those who succeed, the result is a competitive advantage, even during the most difficult global times.

What do these leaders know that others are yet to discover?

By ARC Advisory Group

ARC
Advisory Group

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Executive Overview

The second annual ARC Industrial Digital Transformation Top 25 report continues to highlight companies that are succeeding at integrating digital technology into all areas of business, fundamentally changing the way they operate and deliver value to customers. Based on a rigorous process using financial indicators, transformation indicators, and collective community intelligence, this report identifies and ranks leaders in this complex space. Methodology changes were introduced in this year's report, including the addition of the ARC sustainability index, which is an expansion and replacement of the ESG index reported last year, a reduction in the weighting of the financial indicators and an increase in the weighting of the transformation indicators. Eight new companies joined this year's list. Seven companies dropped off the list and several companies moved either up or down in this list. This movement is an expected outcome, especially given the year over year changing dynamics, and shifting weighting of the three main components of the analysis - financial indicators, transformation indicators, and collective intelligence.

What do leaders know that others have yet to discover? Digital transformation leaders can be found across many different industries, sharing common traits and visions, helping them overcome complex challenges to innovate and stay agile.

Digital transformation leaders can be found across many different industries, sharing common traits and visions, helping them overcome complex challenges to innovate and stay agile. The companies mentioned in this report not only have their transformation initiatives well underway, but they also have their eye to the future tackling the next set of challenges on their journey. What do these leaders know that others have yet to discover?

Digital Transformation

Industrial companies face many challenges and will continue to do so in the future. Whether it is political unrest, climate disruption, pandemics, or global macroeconomic uncertainty, manufacturers are concerned about their operational resilience, agility, and efficiencies. At the same time, manufacturers face pain points and cost drivers such as energy costs, supply chain disruptions, materials shortages, order backlogs, rising prices, workforce dynamics, sustainability requirements, and more.

Transforming to an organization where constant change and adjustment define normal operations is still very conceptual for some industrial companies.

While they may have a similar end goal in mind such as competitive excellence, they may have different strategies and tactics, based on their pain points and priorities. One thing is clear: there is no straight line to define the path of a digital transformation journey. Even though some companies may be ahead of their peers, simultaneously they may still be struggling in many areas of their business and operations.

Successful industrial companies modernize their operating practices and technologies to successfully compete in today's more dynamic and continuously evolving marketplace. Leading companies take a strategic approach, integrating digital technology throughout their value chains. Design and engineering, production operations, maintenance, logistics, supply chain, business systems, customers, products, and organizational structure are subject to innovative change as companies examine and update processes and deploy new tools and technologies. With a digital transformation mindset, the core business model by which a company produces and/or offers services to the marketplace can be replaced by new business models that more fully leverage analytics, digital twins, predictive technologies, or other technologies that enable the company to expand their worldview, embrace competitive excellence as a goal, and thereby move beyond production efficiency to a much more dynamic, responsive, and resilient business model.

Today, some companies are "born digital" and may grow rapidly to overtake existing competitors. These companies are not encumbered by legacy systems, of course, but more importantly, they are unencumbered by legacy thinking and the need to overcome resistance to "the way we've always done it." They can build systems and processes better from the start, and not plan for incremental improvements to eventually achieve top performance.

The Top 25 Industrial Companies
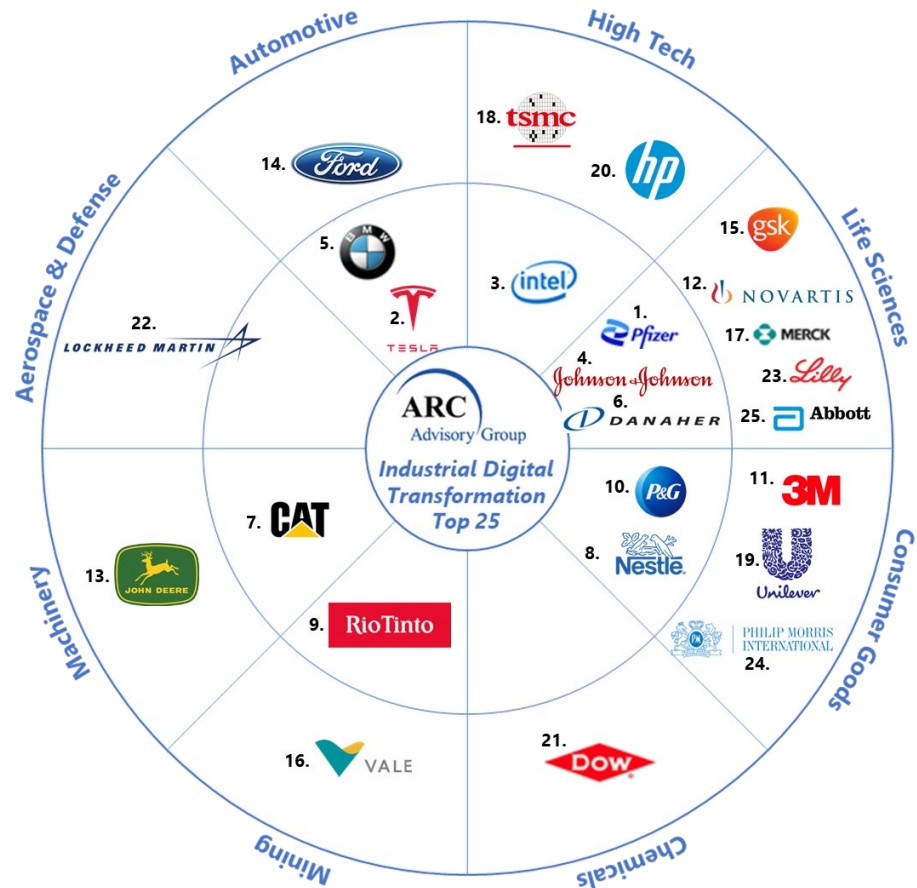
This report identifies the global industrial digital transformation leaders. For this research, digital transformation is defined as: "The integration of digital technology into all areas of business, fundamentally changing the way companies operate and deliver value to customers. The organization is typically charged to innovate and improve across multiple dimensions such as: digital/disruptive technologies, culture and leadership, operational agility, workforce engagement, customer experience, environmental, social and governance, and competitive performance." It's not straightforward to identify leaders in such a complex space, but ARC developed a rigorous process based on financial performance, a community intelligence based ranking system, and software and sustainability data. Publicly available financial information, ARC primary and secondary research, data from ARC's market database, and the opinions of members of ARC's community of end users were all factored into the determination of the *Top 25 Industrial Companies*

in Digital Transformation. The result is an analysis and listing of the Top 25 companies together with their scores in various categories, profiles of each of the leading companies, details about the research methodology, and more.

Analysis, Trends, and Findings

This year's Top 25 companies include many who made the list last year, together with some new companies. Several key trends were identified: importance of sustainability, actively seeking to scale solutions in multiple dimensions, benefits of focus and prioritization, empowering the operational front line, recognition that culture change is required, and active outreach to others.

Analysis

Methodology changes were introduced in this year's report, including the addition of the ARC sustainability index, which is an expansion and replacement of the ESG index reported last year, a reduction in the weighting of the financial indicators and an increase in the weighting of the transformation indicators.

This year eight new companies joined the list – Danaher, Novartis, Ford Motor, GlaxoSmithKline, Vale, HP, Philip Morris International, and Abbott Laboratories.

Several companies shifted position in this year's list compared to last year. This movement is an expected outcome, especially given the year over year changing dynamics and shifting weighting of the three main components of the analysis: financial indicators, transformation indicators, and collective intelligence.

When looking at the tabulated results of this research, there are some instances where a high or low score or voting results clearly pushed a single company forward. However, looking at the collective results, no single metric, at least at this point, pops out as a key indicator of digital transformation success. In fact, there are instances where what seems like obvious success simply is not obvious upon closer examination.

For example, two companies had contrasting financial performance. One made the list, and one did not. Surprisingly, the company that made the list was the poorly performing one. In fact, it was far ahead of the other in terms of digital transformation core competencies and success. In discussions with the company, it indicated that it was driven to transform by the very market conditions that led to its poor performance. On the other hand, the one that was performing well was lagging with digital transformation, with its strong financial position disincentivizing it from changing.

In another example, the results were reversed, with the market position of the strong financial performer a clear outcome of proactive digital transformation efforts. These contrasting examples are further evidence that no singular indicator, in this case financial performance, leads companies to digitally transform.

One important indicator is the accelerating adoption of software by industrial companies. This metric is captured within ARC's Digital Transformation Index score. While it's true that these companies have been purchasing software for many years, their objectives for doing so (as well as what is being purchased) continues to evolve. Leaders see software-as-a-strategy as a pathway to attain competitive advantage, with digital technologies allowing new levels of innovation, speed, and accuracy. From a shareholder perspective that analysis holds true, as an increasing amount of evidence directly links the relationship between software purchases and industrial company valuation.

Sustainability Enters a Fluid Yet Formative Stage

The lens through which sustainability is viewed has changed. Initially, there was a considerable rush to create and market sustainability efforts, particularly in annual reports. Now, most companies are grappling with the fundamental question of what to do when it comes to sustainability starting points. This struggle is not one that many companies feel comfortable sharing with an increasingly skeptical public. So, what changed?

Greenwashing Leads to Regulations with Teeth

In March of 2021, the European Union (EU) made effective the Sustainable Finance Disclosure Regulation (SFDR), which it adopted in 2019. SFDR compliance has led to criticism by many of greenwashing by financial asset managers and impacted industrial companies. Reporting requirements are often identified by detractors as vague and imprecise.

The EU added Corporate Sustainability Due Diligence (CSDD) this year. CSDD aims to curb and eliminate both negative social and environmental impacts from business. CSDD simply feels different, and it is likely to portend more regulations like it, ones with impactful negative bite for non-compliance. It shifts compliance from voluntary to mandatory. Two of the associated obligations — identification and termination of adverse impacts — open the potential for civil liability for non-compliance. The financial risk associated with poor performance is extremely high.

Transparency and Collaboration Prove Difficult

Tackling regulations like CSDD, and the unforeseen ones of the future, will require levels of transparency into data, processes, material, and people resources that are unlike anything industrial companies have yet experienced. What is effective today will seem primitive tomorrow. Both iterative improvement and business transformation are fundamental to success. Most industrial companies are now engaged in existential struggles to determine who is involved, what data is important, and how information will be shared, both within the organization and, most importantly, across the value chain. At this moment, success is proving very elusive, and yet pressure to improve is ratcheting up.

Leaders Seek to Expand Pockets of Success into Scalable Transformations

Many of the top 25 leaders and industrial companies have tasted various pockets of success in modernizing their technology infrastructure and business transformation process. A recent ARC survey of over 1000 global IT and OT manufacturing professionals with knowledge/influence/decision making power on technology adoption and business strategies delineated specific areas where they measured improvement. Productivity, quality, safety, and cost lead the list, but some companies have measured improvements in innovation, customer outcomes, revenue, and new product introduction. The latter group is more closely aligned with real transformations and are evidence of the opportunities still needing to be for many.

Upon speaking with leaders in the top 25, ARC uncovered a common theme: Their next biggest challenge and goal for the upcoming years is how to take a good idea and scale it. Currently that concept of scale is unfolding on two levels. The first is use case based, such as deploying asset monitoring across similar assets or infrastructure in multiple plant or locations. This use-case scale is still very difficult for many. The second, and far more valuable but

difficult, is scaling the *competencies* of digital transformation so that they become ingrained as competitive differentiators capable of being applied across the organization's value chain. As one VP of Digital Manufacturing shared with ARC, *"How do we take our progress in digital transformation deployments in specific departments, groups, locations and implement across all plants in five years?"*

Transforming to an organization where there is a unified global thread or methodology to transform plants, supply chains, ecosystem partners and customer interactions is still very conceptual and challenging for most organizations. ARC predicts that some of the companies seen on the top 25 leader board today will crack the code in the years to come.

Leaders Select and Prioritize Transformation Targets

There are six focus areas that are likely to be candidates for transformation. These functional areas are all subject to disruption or transformation from technologies such as IoT platforms and IoT edge, AI and analytics, and cybersecurity:

- Products
- Services
- Operations (both operate and maintain)
- Design and construct
- Supply chain
- Business processes

Tying all these together, especially for industrial equipment manufacturers, is the need to focus on competitive excellence and transforming the industrial customer experience.

Successful Manufacturers Empower the Operational Front Line

Many experts and operational leaders predict, and fear automation and advanced technologies will rapidly displace factory jobs. However, leading factories are actually understanding and investing significantly in people. Leaders understand the lifecycle of any one worker is shifting and is pushing factories to compete with many other entry level jobs where people are hiking their pay per hour. The result is the factory floor worker is coming and going faster than they ever did before. Today's workers are shifting jobs more frequently, which is reducing the lifecycle of an employee. This is

driving the need for operational leaders to be more focused on providing decision making tools for the workforce. In other words, workers need to understand immediately where to turn for answers. This is vastly different from providing classes of educational training. Recognizing increasing complexities on the shop floor and making technology more accessible to enable people to collaborate with the experts and intelligent software that can guide them on their next steps, are truly transformative measures unlocking significant value and productivity boosts.

Culture Change Is a Requirement for Change

Regardless of how compelling a market signal is, innovators also understand that nothing changes unless company culture is reinvented. The most forward-thinking transformation leaders clearly understand both the importance and challenges of reshaping their cultures, which avoid both risk and change.

Because of these deeply ingrained challenges, these companies emphasize culture change at the executive level, establishing a digital champion leadership empowered to identify and implement change. This change is almost always considered drastic at first, and then it becomes commonly accepted as a standard and the best way of securing the company's ability to compete in digital economies.

Transformation Leaders Aren't Afraid to Learn from Others

Engaging in anything transformational requires learning new things and experimentation. Those requirements present overwhelming challenges for industrial companies that are hardwired by controlled and stable operations and transactions. Leaders in transformation understand that inherent contradiction, and they look outward for better ideas. As a result, another consistent characteristic of digital transformation is the presence of strong digital peer groups outside their traditional industrial ecosystems.

Almost all the companies ARC interviewed noted that when they began their journey, they quickly recognized they didn't have all the answers, either within their own walls or market footprint. In fact, their digital champions began by aggressively expanding their sources of wisdom beyond their historic and current resources.

These expanded peer groups always provided return value. For instance, one company was able to make extraordinary leaps in data management and security. In return, it provided a wealth of leading-edge knowledge on transformational ways of managing highly distributed infrastructure.

Industry Specific Digital Transformation Traits

Digital transformation is occurring across all industries. Companies in the pharmaceutical and biotech, automotive, high tech, consumer goods, machinery and aerospace, chemicals, energy, and mining sectors are among the leaders. While there are many similarities to transformation efforts, there are also industry specific challenges and nuances. A few of which are outlined here.

Mining

Most challenges for the mining industry center around workforce safety, energy costs and energy management, as well as around enduring uptime. The high incidence of component failures in machinery has had significant impact on productivity. Some mines already function as smart mines and are investing in digital technologies for sustainable mining processes. For example, automating mobile assets, such as trucks, and heavy machinery and enabling wireless, and remote readings removes the need for humans to be onsite and increases workforce safety. Mining companies continue to face operational challenges such as shortage of skilled workers, limited availability of equipment and high transportation costs.

Aerospace and Defense

The Aerospace & Defense industry is faced with several challenges including budget constraints that make it difficult to secure funding for research and development, increasing competition that can make it hard for individual companies to stay competitive, and technological challenges that require significant investment in R&D. In addition, the industry is subject to complex regulations and political risks such as changes in government policies and international relations, which can affect demand for certain products and create uncertainty for companies.

One area where digital transformation is having a significant impact in the aerospace and defense industry is in the development of advanced materials and manufacturing processes. For example, companies are using data analytics and machine learning to optimize the design and production of advanced materials, such as composites, which are used in the construction

of aircraft and spacecraft. In addition, digital technologies are being used to streamline and automate manufacturing processes. Another area where digital transformation is having an impact is in the design and development of new products. Companies are using advanced modeling and simulation technologies to design and test new products.

Automotive

The automotive industry has faced a series of challenges for many years. While the pandemic led to massive production halts in 2020, 2021 saw severe headwinds when trying to kickstart a recovery. Supply chain issues, semiconductor shortages, country varying lockdowns, climate commitments are still ongoing issues.

The automotive industry is a major sector embracing digital transformation. They need software and technologies to design new types of vehicles and are spending billions of dollars to optimize their operations and supply chains amongst a scarce labor market to remain competitive.

The automotive industry is generating vast amounts of data from connected vehicles, which can be used to improve vehicle performance, design, and safety. Advanced analytics tools and techniques are being used to extract insights from this data, which can be used to optimize vehicle design, improve supply chain efficiency, and enhance the customer experience.

Chemical

The chemical industry faces several challenges, both in terms of production and regulation. One major challenge is the need to constantly innovate and develop new technologies to stay competitive. Another challenge facing the chemical industry is the need to meet increasingly stringent environmental and safety regulations. The chemical industry is heavily regulated, and companies must comply with a wide range of laws and regulations related to the production, handling, and disposal of chemical products. The industry is also under enormous pressure to become more sustainable and reduce its environmental impact. This requires a significant change in the way the industry operates and requires companies to find new and innovative solutions.

Digital transformation is having a significant impact on the chemical industry. Automation and digital technologies, such as IoT and robotics, are being used to increase the efficiency and safety of chemical production facilities. Digital twin is becoming increasingly important in looking at virtual models

of facilities and infrastructure for simulation and analysis. By identifying inefficiencies, improvements in operations can become significant.

Life Sciences

One of the major challenges of the life sciences industry is the high cost and long time required to develop and bring new products to market. The research and development process for new drugs or medical devices can take many years and require significant investments. Another challenge is the intense competition and rapidly changing market conditions. The industry is heavily regulated in which navigation can be a complex and time-consuming process.

Artificial intelligence is playing an increasingly important role in drug discovery and development helping researchers identify new targets and candidates more quickly and efficiently. Cloud computing and IoT technologies are being used to improve supply chain management and logistics. By using these technologies companies are improving the tracking and traceability of their products, reducing the risk of errors and ensuring compliance with regulations.

Consumer Packaged Goods

Consumer packaged goods companies are facing several challenges in today's market, including increased competition, changing consumer preferences, supply chain complexity, managing price, promotion, distribution, and logistics. The market is highly competitive with new entrants jockeying for market share. To remain competitive, companies look to digital transformation to improve production efficiency, reduce costs, and increase flexibility in responding to changes in consumer demand. Automation technologies, such as robotic systems are being used to improve production speed and precision, while data analytics is being used to optimize production speed and precision. Digital twins are being used to simulate, optimize and validate manufacturing processes, before being implemented in the real world. Digital transformation can become part of a competitive strategy in a market with fickle customer demand and razor thin margins.

Top 25 Companies

The top 25 companies are representative of multiple geographies and industries. Companies in the pharmaceutical and biotech, automotive, high tech, consumer goods, machinery, aerospace, chemicals, energy, and mining sectors are among the leaders. They share a common thread of leveraging digital technologies to transform business capabilities and outcomes, giving them a competitive advantage during challenging global circumstances.

Company	Rank	Profitability as % of Revenue	YoY Revenue Growth	Return on Assets (ROA)	Profit per Employee ($USD)	Community View	ARC Analysts View	Sustainability Index	Digital Transformation Index	Score
Pfizer	1	27.0%	94.0%	13.8%	278,215	813	483	49	81	611
Tesla	2	10.3%	70.7%	10.8%	55,635	1532	490	49	53	595
Intel	3	25.1%	1.5%	11.6%	164,063	910	642	53	50	591
Johnson & Johnson	4	22.3%	13.6%	12.6%	147,339	649	390	51	81	549
BMW Group	5	10.3%	22.5%	7.1%	118,329	635	455	54	53	491
Danaher	6	21.8%	32.2%	9.4%	80,413	215	298	51	93	490
Caterpillar	7	12.7%	22.1%	11.0%	60,251	545	501	49	57	485
Nestlé	8	18.8%	13.1%	8.4%	67,160	619	310	54	62	485
Rio Tinto	9	32.9%	38.1%	28.7%	423,872	143	113	50	77	475
Procter & Gamble	10	18.8%	7.3%	15.2%	141,644	527	134	59	62	474
3M	11	16.7%	9.9%	16.3%	62,326	1183	328	49	24	473
Novartis	12	44.0%	13.8%	20.4%	230,963	173	99	50	81	473
Deere	13	13.6%	23.6%	10.2%	78,928	772	365	46	57	466
Ford Motor	14	13.2%	7.2%	9.5%	98,016	670	337	52	53	464
GlaxoSmithKline	15	12.7%	3.2%	7.8%	65,860	397	263	52	81	463
Vale	16	38.5%	9.0%	32.6%	301,116	14	2	52	77	454
Merck	17	26.8%	1.5%	13.9%	191,897	342	146	50	81	454
Taiwan Semiconductor	18	38.1%	26.5%	17.9%	330,353	224	247	52	50	453
Unilever	19	11.4%	3.2%	12.3%	47,479	330	141	62	62	450
HP	20	10.2%	12.1%	20.1%	127,510	395	280	51	61	450
Dow	21	11.4%	42.6%	12.5%	175,882	924	437	47	24	450
Lockheed Martin	22	9.4%	2.5%	16.0%	55,395	723	492	39	54	448
Eli Lilly	23	19.7%	15.4%	12.9%	159,477	314	252	46	81	448
Philip Morris International	24	28.9%	9.4%	31.4%	130,503	275	32	52	62	443
Abbott Laboratories	25	16.4%	24.5%	11.6%	62,575	229	106	52	93	443

Notes

1) *ARC Analysts View* and *Community View* based on each panel's -ranking order of candidate companies against the definition of Industrial Digital Transformation. (weight 16% and 18% respectively)

2) *Profitability as a % of Revenue* = Profit/Revenue (weight 10%)

3) *Year over Year Revenue Growth (%)* = Change in revenue from year to year. (weight 5%)

4) *Return on Assets also known as asset profitability (%)* = EBIT/Total Assets (weight 10%)

5) *Profit/Employee* ($) = Profit/total number of employees (weight 5%)

6) *Sustainability Score*: Index of environmental, social and governance measures of commitment, transparency and performance. Combination of third-party data and ARC analysis. (weight 18%)

7) *Digital Transformation Index*: Based on ARC proprietary database of technology and industry revenue and growth. (weight 18%)

8) *Score* = (Profitability as a Percent of revenue x 10%) + (Year-over-Year revenue growth x 5%) + (Return on Assets x 10%) + (Profit Per Employee x 5%) + (Community View x 18%) + (ARC Analysts View x 16%) + (Sustainability Score x 18%) + (Digital Transformation Index x 18 %)

9.) All raw data normalized to a 10-point scale, prior to computing final score.

The Top Ten Companies

The top 10 companies stand out for showing substantial progress in transforming their culture, adopting technologies, and embracing digital transformation to enable business outcomes. There is no universal recipe for success and no single company has everything figured out but these companies, while not perfect, are pushing full steam ahead.

1. Pfizer

Pfizer is well advanced on the maturity curve of its digital transformation and is looking toward the future on taking their transformation success and scaling it across all their plants.

Pfizer's CEO is a huge champion for DT for the entire organization. Even before he was CEO, he was the COO and had a program to make change happen. He defines the company's mission as "driving breakthroughs that change patients' lives." As part of that mission, they have embraced digital business transformation to become a leaner, more science-driven patient-focused organization. Three strategic initiatives include the application of digital technologies to speed up discovery and development of medicines and vaccines, enhance patient customer experience and outcomes, and make work faster and easier through the application of automation. Pfizer understands that the age and size of the company tends to foster a mentality of people stuck in the old way of doing things.

To address resistance, the leadership keeps employees engaged throughout the process, solicits their feedback, and provides support along the way. They highlight tangible outcomes during the transition, often gaining proponents of a new way of working. Pfizer, despite being in a highly regulated industry with strict compliance requirements, is an early adopter of cloud technology, and focuses on making sure cloud deployments are as secure, if not more so, than their traditional datacenter environments. The company states this early investment in cloud played a key role in enabling Pfizer to move at the speed required in response to the Covid-19 pandemic.

2. Tesla

Tesla is an American multinational company that specializes in electric vehicles, energy storage, and solar technologies. Tesla can be considered a "born digital" company, as it was in the early 2000s at a time when the internet and

digital technology were rapidly advancing. From the beginning, Tesla embraced technology and the digital world in its business operations and has continued to do so as it has grown.

Tesla's fundamental philosophy internally and externally is to shift perception. Prior to Tesla, the market perception of electric vehicles was a slow, ugly juiced up car with little range. Tesla shifted this perception to one of being a sleek high performance and accelerated mode of transformation. This same strategy is used inside the organization to gain buy-in for digital initiatives and process. For example, when Tesla sets out to automate its internal processes, they try to build it better from the start rather than start a clunky project and hope to get better on revision 4 or 5. This orientation is fundamental in determining what KPIs the company values, as many of them are far different from metrics managed by manufacturers relying on traditional views of success.

By showing value from the start and having internal stakeholders support initiatives, internal employee resistance is minimized. As ARC sees it, this is an example of a company that is comfortable with digital transformation and adapts to business challenges with greater ease quickly. Tesla's digital connectivity has allowed the company to deliver more value to consumers. Their business model is built on the tenet that the vehicles are more like interactive computers with wheels, leading to the creation of an intelligent data platform and connected ecosystem, enabling Tesla to learn from and serve its customers.

Overall, Tesla's digital first status has been a key factor in its success as it has allowed the company to take advantage of the latest technology and digital trends to innovate and disrupt the traditional automobile industry.

3. Intel

Intel, a global semiconductor company, combines technology, people, and culture to drive innovation and quality at the production line while ensuring sustainability and safety throughout the business process. Intel's semiconductor manufacturing process runs 24 hours a day, 7 days a week, 365 days a year. Digitally transforming its manufacturing operations around connectivity and IoT have fundamentally changed the way Intel runs its day-to-day business – from the types of products and services produced to how they are delivered. While automation has been used for several decades inside the factories, real improvement and transformation has come from the

deployment of widespread IoT and predictive analytics at scale, which have demonstrably decreased time to market, improved resource utilizations, increased yields, and reduced costs.

Intel focuses on connecting data insights directly with engineers who can focus on solving problems, with an emphasis on designing solutions instead of extracting data. Digital twin and simulations help optimize the factory output. Even though the company focuses on technology, it is an ecosystem play, not just one technology that delivers a full-blown solution. For Intel, it is the combination of the people, the culture and technology all together, that defines its digital transformation. Intel is also committed to corporate responsibility and sustainability throughout their entire business.

4. Johnson & Johnson

Johnson & Johnson and its subsidiaries produce medical devices, consumer package goods, and pharmaceutical products. J&J has a reputation for its corporate culture which values social responsibility and has been recognized for its efforts in sustainability and environmental responsibility.

Johnson &Johnson's digital strategy includes cross-functional partnerships and a new culture around its digital tools, company-wide. Emerging as a leader in 3D printing, IoT and automated order fulfillment, the company is using artificial intelligence as part of their product development. IoT is being used to track and trace products throughout the entire supply chain, from manufacturing to distributors and to medical facilities such as hospitals. Getting access to real-time information has helped manage inventories, anticipate product demands, and drive high-value manufacturing decisions. In addition, knowing where a product is and whether it is being maintained in a proper manner (such as temperature control for a vaccine) provides a higher level of quality assurance.

J&J is heavily invested in data science starting with its Data Science Council. The goal of the council is to use data to validate the decision-making process to make a positive impact. The council is made up of members from supply chain, R&D, finance, and HR. Artificial intelligence initiatives are enabling the company to continuously create breakthrough drugs and surgical solutions.

5. BMW Group

The BMW Group is a leading manufacturer of luxury automobiles and motorcycles. The company has embraced digital transformation as a way to enhance the customer experience, improve efficiency and productivity, and develop new products and services. To this end, BMW has implemented various digital initiatives, such as the use of data analytics and AI to optimize its manufacturing processes and supply chain, as well as the development of connected and electric vehicles. BMW has implemented digital technologies to improve communication and collaboration within the organization, including the use of cloud-based collaboration tools and virtual reality training simulations. Additionally, BMW has been taking the next step in the systematic integration of additive manufacturing by scaling up to industrial levels for vehicle development and production. By additively manufacturing metal and polymer parts at various points in the process chain and different sites across the global network, the company has transformed its production process. Looking toward the future, BMW is investing millions of dollars over the next five years as it looks to create a seamless digital experience for customers, increase efficiency, and drive innovation.

6. Danaher

Danaher is a global science and technology company that designs, manufactures, and markets professional medical, industrial and commercial products. The company has operations in over 150 countries and employs approximately 71,000 people globally. Danaher operates in four business segments: Life Sciences, Diagnostics, Dental, and Environmental & Applied Solutions. Danaher has a strong focus on innovation and operates several research and development centers around the world. The company strategically employs emerging technologies, including machine learning, AI, Big Data, IoT and cloud to optimize operations and deliver transformative experiences. Danaher also has a strong commitment to sustainability and has set several goals to reduce its environmental impact.

7. Caterpillar

Caterpillar is a leading manufacturer of construction and mining equipment, diesel and natural gas engines, and industrial gas turbines. The company has embraced digital transformation using technologies such as IoT, data analytics, and AI to improve the efficiency and productivity of its operations. In the area of transportation, Caterpillar has implemented various digital

initiatives, such as the use of telematics systems to track and monitor its fleet of vehicles, as well as the development of autonomous vehicles for use in its operations. In addition, Caterpillar has invested in the development of digital tools and platforms to improve the maintenance and repair of its transportation equipment, including the use of predictive analytics and machine learning to identify potential issues before they occur.

The company looks at its digital transformation as a journey comprised of five key steps: Drive digital transformation from the top; define digital vision; develop a digital strategy; create a digital roadmap; and build a digital organization structure.

8. Nestlé

Nestlé is one of the largest food companies in the world, with operations in 191 countries and a portfolio of over 2,000 brands. Digitalization covers all aspects of Nestle's business from internal organization to external engagements. The company is advancing as a digitally enabled data powered business. Digital transformation is business-led and consumer-centric. This includes using analytics, automation (all factories are equipped with collaborative robots), artificial intelligence and e-business. The IT organization is part of the digital transformation program delivering value to the business, rather than simply IT systems and services that meet operational targets. Nestle's digital transformation strategy is known as Vision2Life and has four key priorities: bring value to the people who receive IT services; operate as one global IT team but with local expertise; interlock product management with business stakeholders; and make IT a technology differentiator not just a provider. Their transformation exists in several ways including leadership, culture, technology and ESG. Everyone from procurement, manufacturing, sales, and marketing are involved. Digital transformation at Nestle is about business outcomes: increasing capacity, decreasing cost, increasing product innovation and availability of goods. Empowering people with information to make faster decisions is at the core of Nestle's culture.

9. Rio Tinto Group

Rio Tinto is one of the world's largest mining companies. One of Rio Tinto's key initiatives has been the development of its "Mine of the Future" program, which aims to use technology to improve safety, reduce costs, and increase productivity. As part of this program, the company has implemented advanced analytics systems, autonomous vehicles, and smart

sensors at its mining operations. The program equips frontline employees with intelligent tools that allow them to make decisions that improve performance based on contextual knowledge. Rio Tinto's approach is multi-faceted, meshing technology, employees, and partners. The company has partnered with Caterpillar to supply and support mining machines, automation, and enterprise technology systems. Automation augments the job of the human and creates opportunities for staff to develop their skills to support a digitally transformed company.

The company intends to reduce its carbon emissions by 50 percent in 2030 and to net zero by 2050. To do so Rio Tinto is using cloud-native and Big Data analytics technologies to better understand electricity usage during the production and processing of aluminum.

Fully integrated mine operation and simulations systems fueled by digital twin technology and artificial intelligence combine data from actual processing plants with historical information. This gives the team in the field and at remote operations centers the ability to access the same information and make decisions in a fraction of time - sometimes in a matter of minutes vs. hours or days. Business outcomes are measured through enhanced safety and productivity, which turns into profits. Smart mining is truly transformative, using information, autonomy, and technology to obtain enhanced safety and productivity while reducing costs.

10. Procter & Gamble

P&G is a consumer goods company with operations in more than 70 countries. The company is advancing their partnerships and implementing IIoT, digital twins, and AI to bring products to consumers faster and increase customer satisfaction, while improving productivity and reducing costs. Collaboration among employees, evolution of new products, improved production systems, supply chain & distribution optimization, and customer relationships are at the heart of their transformation strategy.

True to its innovative nature, P&G sees data and algorithms as a way to constructively disrupt how it operates, leading to growth. P&G has developed a multi-cloud driven data strategy and data culture that informs every decision of the business. Artificial intelligence, machine learning, and advanced analytics are all seen as crucial to becoming a true digital leader.

Companies 11-25

11. 3M

3M is a diverse company with a strong focus on innovation and a long history of scientific and technological achievements. The company has made considerable progress over the past year in breaking down the silos between OT and IT. Together they have found ways to do more with less by integrating new technologies and processes on the production floor, resulting in measurable cost reductions. In 2021, leadership has made a $1 billion commitment to achieve carbon neutrality, reduce water use, improve water quality, and reduce use of plastics.

The company has four business groups, 22 operating divisions, 51 technology platforms and thousands of products sold in 200 countries. As part of internal operations, they have connected 240 plants, distribution centers and enabled capability to monitor the flow of products. The company used to operate autonomously in the local country subsidiary structure, but now their digital transformation efforts are driven more to alignment and standardization.

3M is utilizing several emerging technologies including artificial intelligence, Big Data and robotics, among others to streamline production, reduce costs, develop new products and services, and enhance supply chain efficiency. Data analytics, culture and prioritization are the three enablers driving a robust transformation effort within 3M.

12. Novartis

At Novartis, Covid-19 was a tipping point between just knowing what was possible with digital transformation and the reality of having to unlock change in the midst of a crisis. With over 100,000 employees the company develops and manufactures healthcare products in over 100 countries. After pre-Covid missteps in trying to transform in IT driven silos, the company took a new approach moving its technology infrastructure to the cloud, invested in data integration platforms and transformed its staff and culture. The company deployed AI modeling throughout the firm. Silos were broken and units developed shareable knowledge – one version of the data – to enable innovation.

13. Deere & Company

John Deere is one of the largest manufacturers of agricultural and construction equipment in the world. The company uses digitalization to create more dynamic logistics and production planning, improve the visibility and accuracy of materials throughout the global supply chain and add the ability to customize real-time user instructions. Deere has been focusing on streamlining its end-to-end construction site operations through process automation. It has been investing and implementing digital technologies, such as AI, cloud, autonomous vehicles, IoT, drones and analytics to improve equipment efficiency and job site operations. Deere's digital transformation starts from product designs and continues all the way through supporting the customers.

Deere has continually transformed itself to be more agile and project based. The company upped its investment to fuel its 5G and manufacturing and 4.0 ambitions. In addition to powering a new suite of high-performance computing analytics, 5G will enable the adoption of edge computing and autonomous devices as well as a larger set of smart applications like real-time location systems, asset tracking inventory management, wearables, production automation and robotics.

14. Ford Motor Company

Ford is one of the oldest car manufacturers in the world. Ford fosters a culture of innovation and transformation and was an early adopter of cloud as part of their culture of experimentation.

Ford also was an early adopter of 3D printing. Initially used for rapid prototyping, additive manufacturing is now being used to assist in production applications, and to support mainstream production. 3D printing is supporting current production processes with more efficient tooling, jigs, and fixtures. Product development processes have accelerated, due to the ability of designers to make 3D printed models of several different designs, which can then be tested by engineers simultaneously, saving the company money in not having to make several iterations of the same design. Ford has also invested heavily in automation and robotics technologies to improve the precision and speed of its manufacturing processes. This includes the use of robotics for assembly line tasks such as welding, painting, and finishing. Automation has helped to increase production capabilities, improve quality, and mitigate the need for manual labor.

The company is also committed to sustainability from the way they source materials, to the way they manufacture vehicles and the services and interactions they have with their employees, customers and communities.

15. GlaxoSmithKline

GSK, a large pharmaceutical company, has made significant progress in its digital transformation efforts. The company's strategy involves integrating culture, data, and technology, with a strong focus on using data for informed decision-making and encourage taking smart risks. The underlying philosophy behind GSK's digital data and analytics solutions is to empower them across the enterprise.

The digital transformation includes the implementation of strategic partners, the transformation of skills, the adoption of agile ways of working and a product-centric approach to managing tech delivery, the acceleration and adoption of future-proof technology, and maintaining a robust core to enable the business to operate in a secure manner during transformation. Advanced technology platforms are central to the company's R&D approach. A dedicated global in-house AI team uses machine learning to unlock the potential of complex genetic data.

16. Vale

Vale, a multinational mining company based in Brazil, is one of the largest producers of iron ore and nickel in the world. The company has operations in over 30 countries and employs over 100,000 people. Vale has a strong commitment to sustainability and has invested in various initiatives to reduce its environmental impact, such as reforestation, water management and renewable energy. The company utilizes Artificial Intelligence tools that anticipates information from regions at high risk of deforestation and fires as part of its efforts to protect the Amazon.

Vale has implemented several digital transformation strategies to improve logistics and supply chain management. This includes using advanced tracking systems to monitor the movement of materials and products as well as analytics to improve scheduling of transportation and logistics. The company has implemented advanced automation technologies such as autonomous vehicles, in its mining operations to increase efficiency and reduce the need for manual labor. This has led to improved production capabilities and cost savings.

17. Merck & Company

Merck's three key business sectors across 140 countries - healthcare, life science, and performance materials - develop strategies to drive new product developments for the benefit of patients and customers. The company identifies innovation projects with the goal of moving beyond their current portfolio, from initial idea all the way to functioning business model. Merck has been focusing on using artificial intelligence, cloud, Big Data, IoT, and 3D printing to digitally transform its operations and to improve the performance of its laboratories.

In addition to its process-oriented digital transformation elements, Merck is also working on stealth digital strategies, or open standards. These efforts include working with standards organizations for easier integration into the company's manufacturing and laboratory activities. A strong proponent of standards, Merck believes that by deploying, engaging, and adopting more standards it will drive productivity into the organization.

Culturally, the company has an Innovation Committee (IC) that oversees the implementation of innovation projects both between and beyond its business sectors. It ensures that the decision-making process for selecting innovation projects is transparent and consistent.

18. Taiwan Semiconductor Manufacturing

TSMC is the largest, most technologically advanced, independent semiconductor foundries in the world. The company has implemented various digital tools and systems to automate and optimize its manufacturing processes, such as using machine learning algorithms to predict and prevent equipment failures and using data analytics to improve production yields. These measures have helped TSMC to improve its operational efficiency and reduce costs. Another area where the company has invested in digital transformation is in its supply chain by implementing digital tools to improve visibility and transparency. With the advent of Big Data, TSMC gradually shifted toward information-oriented innovation and revamped its decision-making process based on the idea that "everyone is a decision-maker" in a bid to improve its response time and the quality of strategic decisions. It also established an IC design ecosystem ranging from "virtual fabrication" to "open innovation" platforms. Just as the acceleration in digital transformation has made semiconductors more pervasive and essential in people's lives, it has also brought a focus on internal innovation in the semiconductor

industry. TSMC has fostered innovation through active collaboration with partners collaborating, developing and optimizing across process technology, electronic design automation (EDA), IP and design methodology. The company also scores high on social governance and is continually improving its emissions and resource use as part of environmental efforts.

19. Unilever

Unilever, a global consumer goods company, actively digitizes all aspects of their business to leverage data and increase digital capability in everything they do. The company has implemented IoT, artificial intelligence, virtual reality, and digital twin technology to automate and optimize production processes and gain better visibility and insights into production data. More specifically, artificial intelligence is used to predict demand, co-create new brands with consumers, and to target customers precisely with the specific products they want. Unilever has been investing in cloud-based Manufacturing Execution Systems (MES) to enable remote monitoring and control of production lines, and to facilitate collaboration and data sharing across different manufacturing sites. Unilever views digital transformation as a necessity, not an option, to overcome the market challenges faced by consumer goods companies. Unilever uses Big Data to bring the "right" products to market faster. A cultural transformation underpins the success of digital transformation, and Unilever invests in a skills transformation program across the entire organization.

20. HP

HP is a large technology company operating in more than 170 countries with over 300,000 employees. HPs product portfolio is diverse and includes a wide range of products for both consumers and businesses. Its personal computer and printing divisions are among the company's most well-known and successful businesses. In recent years, HP has made significant investments in the areas of artificial intelligence, Big Data and IoT with the goal of staying competitive.

HP's digital transformation has been focused on turning data into meaningful insights that can be used to run a much better business. The company has been using data analytics and artificial intelligence to gain insights into business operations. Additionally, the company has invested heavily in the cloud and automation technologies.

21. Dow

Dow, a global chemical company, is divided into three main segments: Materials science, Agricultural sciences and Specialty products. Dow has been on a digital transformation journey for several years and in 2021 announced a $400 million investment to accelerate digitalization throughout the company. Their digital strategy is to move from simply being a chemical company that "does digital" to becoming a digital developer of new materials. The company's manufacturing Industry 4.0 initiative revolves around customers, employees, and processes. Breaking down traditional organization silos between OT/ET and IT organizations and building an environment of trust, cooperation, benchmarking, and free and ongoing collaboration led to the creation of a joint innovations team which has been paramount to its success. Additionally, the company developed the Dow Digital Operations Center (DOC), which brings together the deep domain expertise resident across the company.

A few examples of the new digitally enabled capabilities developed at the DOC include using drones and robots to help make Dow a safer place to work and enhance the quality of inspection work. Virtual reality is used to help engineers solve problems early and with lower risk. The company has also rolled out innovations that help to track both people and equipment better. Culturally, the transformation vision is woven throughout the company from it being a line item on the financial books, to the CEO, and to every business unit; some have a digital transformation leader who reports to a business president.

22. Lockheed Martin

Lockheed Martin is transforming across its entire business to deliver the speed, agility, and insights to its customers. In 2021, the company completed four new digital factories in the United States. These are connected to the intelligent factory framework, and edge computing platform that secures, scales and standardizes device connectivity through IoT practices. The company is adopting disruptive innovation in their processes, technology, and tools to drive faster deliveries, agile responsiveness, and data-driven insights for their customers. A few key concepts define Lockheed's strategy. The first is digital engineering – model-based engineering, optimizing design and links design, manufacturing, and sustainment teams on a common digital thread to save costs and speed program lifecycles. Second, next-generation software is enabling fast and continuous development. Additionally, digital

enablement by investing in process reinvention and business system modernization. Technologies such as 5G networking, cloud, and artificial intelligence provide the foundation for Lockheed's continuous transformational capabilities. Data is viewed as strategic asset and AI-powered predictive analytics is used to glean insights that advance performance from factory to the field.

23. Eli Lilly

Eli Lilly's core business is the discovery, development, and manufacture of pharmaceutical products. Through its history, Lilly has prided itself for its innovative research, corporate responsibility, and contributions to the pharmaceutical industry. They see the digital plant as a way to accelerate improvements. For example, the company reduces ergonomic risks by using robotics for lifting boxes and ensures quality through real-time analytics rather than after-the-fact testing. These technologies also drive cost efficiencies. Additionally, Eli Lilly has been investing in technologies such as blockchain and digital twins to improve supply chain traceability, logistics and inventory management, and quality and regulatory compliance.

The digital plant and technologies that go along with digital transformation, such as robotics, data analytics, artificial intelligence (AI), and the industrial Internet of things (IIoT) - promise greater efficiency. Eli Lilly has been advancing in applying these technologies to its pharmaceutical manufacturing organization, which the company claims has enabled it to make better medicines. The company established a role dedicated to corporate global reliability, which involves helping silos to communicate, making them more comfortable, not always leading but at least interacting.

24. Philip Morris International

Philip Morris is a formidable player in the global tobacco industry and has been focusing on becoming a digital leader. The company believes the industry cannot continue with its current business model and must embrace digital transformation to drive efficiency and change how it develops and markets new products. The company is driving its change around three pillars. The first one is about how to deal with legacy built over the past 10 – 20 years. Reducing the legacy footprint is step one in opening the door for change. The second pillar is centered on bringing state-of-the-art technology (such as AI and cloud) into the organization. Third is the leadership and messaging. The CIO is quoted as saying "We are not transforming for the sake of technology.

We are transforming for the sake of creating products and better experiences for our customers and consumers." The company keenly recognizes the importance of culture change in leadership, organization, and processes.

25. Abbott Laboratories

Abbott Laboratories manufactures and markets a wide variety of healthcare products and services including diagnostics, medical devices, pharmaceuticals, and nutrition. The company operates in over 150 countries and has a strong presence in developed and emerging markets.

Abbott's data collection and analysis fuels AI and machine learning tools. With vast troves of data collected from customers through websites and apps, Abbott has a clear picture of what customers want and need – and when they need it. Abbott learns from this data and predicts next generation products. Abbott states automation is one of the most impactful technologies being applied to shorten time to market and continuous process improvement.

Companies of Note

Many noteworthy companies fell out of the DT Top 25 list for one reason or another. But a few have been identified either by the peer community, analyst community and/or the top 25 leaders as digitally transforming companies worth mentioning. ARC identified the following companies based on their demonstrating many of the same characteristics of successful transforming companies in the top 25.

BASF

BASF, a leading chemical company operates in over 80 countries and has more than 117,000 employees. The company takes a holistic approach to digitalization with the use of technology being used to solve concrete issues that translates to business outcomes. For BASF, digital is a tool to make the business better and the company invests in the company culture to make sure the tools are put into use. BASF strives for its vision to make digitalization an integral part of its business to create additional value for customers, grow the business, and improve efficiencies. The company is using digital

technologies to integrate the supply chain with customers, suppliers, and partners. Addressing environmental and social challenges is a crucial component of the corporate strategy. The company has set several sustainability targets, including reducing greenhouse gas emissions, increasing energy efficiency and sourcing from renewable sources. BASF is focused on the circular economy by developing sustainable products, as well as recycling and waste reduction efforts.

Cargill

Cargill is a large global agricultural company employing over 150,000 people in 70 countries. Cargill is a 157-year-old company and has been overcoming legacy thinking to digitize and implement smart manufacturing in all its plants and establishments. At the highest level, Cargill's expected outcome of smart manufacturing is "to use data to maximize production yield." Along with smart manufacturing, modernizing its infrastructure has been a major area of focus as part of an overall digital transformation strategy. The company has made significant movements toward the cloud and has invested heavily in cybersecurity. Now that the technological foundations have been laid down the company can use data for more strategic business outcomes such as optimizing power, water and other inputs. The company is well underway on its journey and is presently focusing on digital twins to vary parameters on the production line.

Cargill is also committed to sustainability and is focused on reducing its environmental impact, promoting sustainable agriculture and investing in renewable energy.

General Mills

General Mills is one of the largest consumer packaged companies, operating in over 100 countries. The company invests heavily in R&D and to help keep up with ever-changing consumer preferences and trends. The company is using AI and predictive analytics in its innovation process, to test, learn and develop new products.

General Mills has been recognized for its corporate responsibility in areas regarding workplace safety, diversity, inclusion and community engagement. Additionally, the company has implemented a number of sustainability initiatives to reduce greenhouse gas emissions, water usage, and increase sustainable sourcing.

The company continues to embrace Industry 4.0 across its manufacturing plants for operational KPI and is tackling the challenge of scaling transformation across different plants that may differ culturally and operationally.

Georgia-Pacific

Georgia-Pacific produces wood products, paper, pulp, and related chemicals for a wide range of products serving customers in more than 75 countries globally. In industrial circles, Georgia-Pacific is often held up as an example of how market urgency can galvanize a traditional company to change fast and well. Its mantra for digital transformation is to make it easier and faster for its customers to do business with the company. That ideal has driven massive change in how Georgia-Pacific operates. It went all out on its transformation when most companies were still educating themselves about what needed to change and/or were gingerly testing the waters through very limited technology pilots. With its mantra informing its key team of visionaries, Georgia-Pacific first identified and eliminated what it termed "impedances" that added cost or time to customer fulfillment. That led the company to revamp its supply chain (by insisting on supply chain transparency), develop new incentives for plant performance, rethink customer engagement, and identify and secure the key subject matter experts that underpinned its competitive intellectual property. In going through this process, the company very clearly understood what digital transformation technologies were of value to them and how they could deploy the best mix of off-the-shelf and internally developed solutions.

Georgia-Pacific has pioneered the development of two key systems that manage a great deal of the competitive advantage they have developed via digital transformation. Cognitive analytics and the dynamic use of machine learning are central to these solutions. From the beginning, Georgia-Pacific clearly identified the desired business outcome they needed to achieve through transformation. The company continues to identify and eliminate as many manual and low-value tasks as possible. Georgia-Pacific also has developed "digital companions," which help its people focus on higher value work that improves the customer experience while also delivering the best business outcome for the company.

Moreover, Georgia-Pacific has been working on sustainability initiatives that leverage digital technologies. For example, the company has been using data analytics to optimize energy and water usage in its mills, as well as to reduce its carbon footprint.

Saudi Aramco

Saudi Aramco is considered the world's largest oil company by both production and reserves and operates a vast network of oil and gas production facilities, including drilling rigs, pipelines, and storage tanks, as well as several refineries and petrochemical plants. Saudi Aramco has a number of digital transformation projects across different locations to optimize productions, improve drilling efficiency, and enhance safety. The giant's gas processing plant has become a leader in a number of Industry 4.0 technologies including the use of Artificial Intelligence and the use of drones to inspect pipelines and wearable technologies that help workers cut the time it takes to make inspections and repairs. One if its oil fields was built as a fully connected and intelligent field with over 40,000 sensors covering over 500 wells. This enabled autonomous process control, remote operation and monitoring of equipment and pipelines.

The ARC DT Top 25 Team

This report is the fruition of an idea that matured over several years, spurred by the many experiences and interactions with end users, their challenges, and research by ARC team members. These experiences were provided by both leaders and laggards in industrial innovation. End users commonly ask, "what separates success from failure?" ARC began to study the characteristics of success and created the ARC Industrial Digital Transformation Top 25 report.

As the report came together, several key findings were uncovered. Primarily, the research and data confirm trends that ARC has uncovered and documented for the last 5-7 years. These trends lend credence to the ARC conclusion that digital transformation is not occurring in a straight line.

That is, industrial innovation is typically a messy process. No single route to success exists. Data and technology are enablers, not launch points. Instead, those launch points come from creative problem solvers who, when faced with intense market disruption, decide that the old way of doing things simply won't suffice.

ARC tapped its global analyst community to contribute to and support various aspects of this report. This included developing suitable metrics,

acquiring the necessary financial data, identifying regional companies strong in digital transformation, and more.

The core report team consists of the following analysts:

Marianne D'Aquila
Director of Research

Mike Guilfoyle
Vice President, Sustainabil-

Mark Sen Gupta
Director of Research

Greg Gorbach
Vice President, Digital Transformation

Methodology

ARC employs a rigorous process to identify and rank leaders in this complex space. The ranking comprises three main components – financial indicators, transformation indicators, and collective intelligence (for more detail see the scoring and weighting components section below). Financial indicators, in the form of public financial data, provides a view into how companies have reported recent performance. Transformation indicators are based on software and sustainability data. Collective intelligence is based on selection and ranking by ARC analysts and broader end user community.

Definition

For this research, digital transformation is defined as: "The integration of digital technology into all areas of business, fundamentally changing the way companies operate and deliver value to customers. The organization is typically charged to innovate and improve across multiple dimensions such as: digital/disruptive technologies, culture and leadership, operational agility, workforce engagement, customer experience, environmental, social and governance, and competitive performance."

Candidate Companies Inclusion/Exclusion

A master candidate company list was derived from companies on the Global Fortune 500 or the Forbes 2,000 list, using a general annual revenue/sales threshold of $20 billion. This threshold was implemented to keep the list at a manageable level. Candidate companies must operate in industrial industries (full list of industries included below). Companies were excluded if they have a line of business selling industrial automation or information technology (i.e., Siemens, Rockwell Automation, GE etc.) or if there was an obvious lack of digital transformation effort.

Industries Included

Companies must operate in at least one of the following industrial sectors.

- Aerospace & Defense
- Automotive
- Cement & Glass
- Chemical
- Electronics & Electrical
- Fabricated Metals
- Food & Beverage
- Household & Personal Care
- Machinery
- Medical Products
- Metals

- Mining
- Oil & Gas
- Pharmaceutical & Biotech
- Plastics & Rubber
- Printing & Publishing
- Pulp & Paper
- Refining
- Semiconductors
- Textiles
- Utilities
    - Electric Power Generation
    - Electric Power T&D
    - Water & Wastewater

Scoring Components and Weighting

The scoring comprises three main components – financial indicators, *transformation indicators and collective intelligence.*
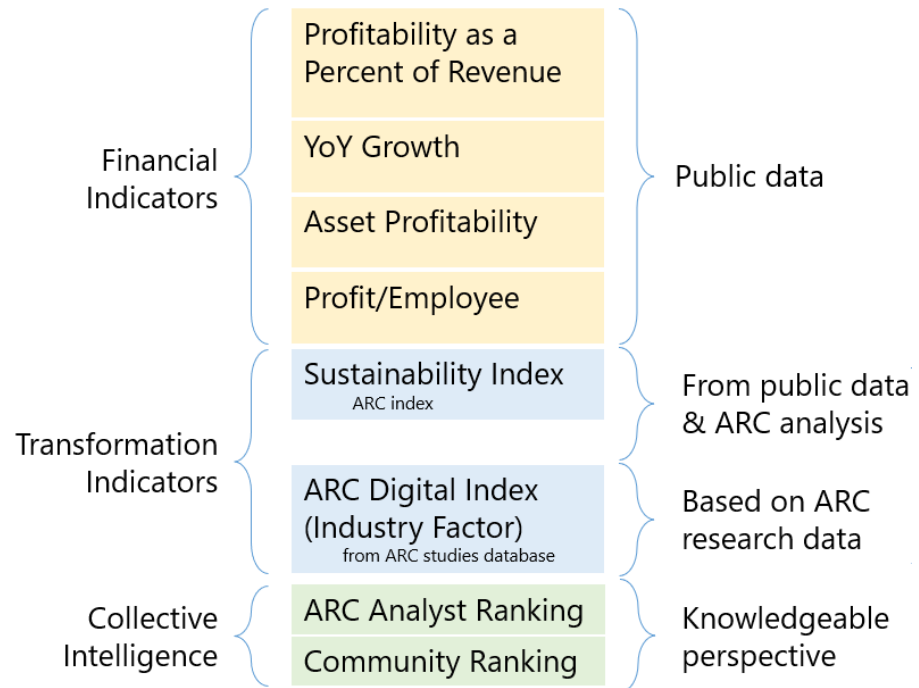
Financial Indicators

The financial indicators are public data extracted from the *Refinitiv Eikon (Formerly Thomson Reuters)* database. More specifically, the four subcomponents and their significance are as follows:

Profitability and growth are positive business outcomes of some companies that are well down the digital transformation path. Year over year revenue growth and profitability were chosen as metrics because they are widely seen as strong indicators of digital transformation outcomes. Most of the successful companies have stated their revenue growth and profitability would suffer in the future if they didn't digitally transform quickly enough. Ultimately industrial companies must extract value from assets, so this metric was selected. A major purpose of digital transformation is to create value by enabling employees to work more efficiently. Profit per employee was selected as a metric because it measures the efficiency by which a company is utilizing their workforce.

Transformation Indicators

We believe that Sustainability is a strong indicator for digital transformation. ARC's sustainability index is a compilation of ARC metrics including sustainability investment potential and sustainability risk factor, and external publicly available ESG metrics. There is an increasing push across global industries to incorporate ethics and sustainability into business practices. Environmental, social and corporate governance is a business outcome resulting from a successful transformative process.

For industrial companies, a correlation has been identified between investment in software and other transformational technologies and the company's valuation. Appropriate software and technology research study data – including historical and forecast data for areas such as MES, ERP, Cloud Platforms, Analytics, and others - were used to generate a Digital Transformation Index (DTI) derived from ARC's proprietary research database.

Collective Intelligence

This report relies heavily on the collective intelligence of ARC's community. Collective intelligence component scores reflect the progress companies are making as demonstrated by the level of awareness and visibility in the knowledgeable industrial community as well as ARC analysts.

Over 100 community members and analysts from North America, EMEA and Asia Pacific participated. They come from a diverse group of industries, including high tech, pharmaceutical, consumer goods, automotive, machinery, aerospace & defense, mining, and energy. Industry organization representatives and members of academia are also included.

Sample titles of community members include Global Digitalization Director, VP of Automation, VP of Innovation, General Manager of Transformation, Digital Lead and various C-suite and business group executives. Community panel polling was conducted from August to November 2022 via a web-based, two-step process. Panelists were presented with the entire list of about 200 candidate companies in a randomized fashion. They were provided a brief description of each company's digital transformation and a link to the company website. They were not required to do any additional research, though it was possible to do so. First, panelists were asked to choose up to 25 companies they believe to be digitally transformed. Next, the panelists rank-ordered the selected companies from 1 to 25 with 1 being the most digitally transformed. Companies needed to receive at least one community or analyst vote in order to be considered.

Digital Transformation Score

The four financial indicators, two transformation indicators and two collective intelligence indicators were normalized and aggregated using the aforementioned weighting, into a total score. These scores were ranked from high to low to arrive at the top 25. Weights were chosen based on a best estimate of correlation to digital transformation. For example, revenue growth and profitability are weighted quite heavily as they are typically stated as a top outcome of transformation. ARC will review and adjust these weights each year to ensure the most appropriate measures are being used.

Looking Forward

ARC will continue its research in all areas related to digital transformation. We want to learn more about what is working – and what isn't – as companies pursue their unique digital transformation activities. We want to hear from technology and service providers who have helped customers achieve interesting transformations, and from industrial companies – technology users – who have accomplished transformations they are proud of.

We intend to publish the Industrial Digital Transformation Top 25 report on an annual basis. With this being our second year, your feedback continues to be very important to us as we will continue to investigate new approaches and measures to adjust our methodology, identify successful digital transformation initiatives, and help the industry as a whole digitally transform.

Please reach out to ARC if you have some results or learnings from your own digital transformation initiative that you would like to share. If you would like to be considered for inclusion on our community panel of judges, please contact us. And if you are willing to provide feedback to help ARC improve the process for next year's report, or to learn more about ARC products and services, please contact us.

For these or any other concerns, please contact **Marianne D'Aquila** at **mdaquila@arcweb.com**

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Acronym Reference:

AI	Artificial Intelligence	**IIoT**	Industrial Internet of Things
CSDD	Corporate Sustainability Due Diligence	**IoT**	Internet of Things
		IT	Information Technology
DT	Digital Transformation	**KPI**	Key Performance Indicator
EDA	Electronic Design Automation	**MES**	Manufacturing Execution System
ESG	Environmental Social and Governance	**OT**	Operational Technology
		SFDR	Sustainable Finance Disclosure Regulation
ERP	Enterprise Resource Planning		
EU	European Union	**YoY**	Year over Year

Founded in 1986, ARC Advisory Group is the leading technology research and advisory firm for industry and infrastructure, including our emerging smart cities. ARC stands apart due to our in-depth coverage of information technologies (IT), operational technologies (OT), engineering technologies (ET), industrial cybersecurity, and associated business trends. Our analysts and consultants based in the US and around the world have the industry knowledge and first-hand experience to help our clients find the best answers to the complex business issues facing organizations today. We provide technology supplier clients with strategic market research and help end user clients develop appropriate adoption strategies and evaluate and select the best technology solutions for their needs. End users are also invited to participate in ARC's Digital Transformation Council.

You can take advantage of ARC's extensive ongoing research plus the experience of our staff members through our Advisory Services. These are designed to assist executives responsible for developing strategies and directions for their organizations. ARC has also introduced a high-level Vanguard Service for end users. Vanguard employs a more personal consultative approach to help Chief Digital Officers and transformation change agents overcome obstacles and drive digital innovation in their organizations. For membership information, please call, write to, or visit our website: www.arcweb.com.

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