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# IBM Watson Health Growth Strategy: Is Artificial Intelligence (AI) The Answer

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# IBM Watson Health Growth Strategy: Is Artificial Intelligence (AI) The Answer

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**Abstract:**

IBM is a technology services and consulting company. It provides solutions in analytics, IT infrastructure, cloud computing, business automations, cybersecurity, data storage, application development, blockchain, and consulting solutions (Bloomberg, n.d.). It has a decades-long history of artificial intelligence (AI) experimentation and research. Watson was a generation of AI machines IBM built that could ingest vast amounts of information from multiple sources, understand questions posed in natural language, and answer them accurately. With this AI capability, IBM ventured into healthcare with the objective of monetizing Watson for cancer detection, diagnosis, and treatment recommendations. While it achieved some success, it was encountering challenges with accuracy, ethical issues with AI, and in making the division profitable. IBM faced a strategic choice: retain Watson's focus as a healthcare information system (IS) or reposition it as a cross-industry AI platform on which businesses can build, deploy, embed, and scale machine learning models for their operations and offerings. Another alternative was a unified technological framework that converges these two approaches. This article explores these options and provides insights into the opportunities and challenges in unlocking the transformational power of AI.

**Keywords:** Artificial Intelligence (AI), AI Strategy, Watson, Healthcare AI, Vertical AI, Horizontal AI, AI Ethics.

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# 1 Introduction

> *"The decision on Watson Health has got nothing to do with our commitment to AI and for the Watson Brand, The Watson brand will be our carrier for AI. It is a question of verticals versus horizontal growth. We believe we are best positioned to take these technologies."*
>
> Arvind Krishna, IBM CEO, 8 Jun 2022

The IBM CEO spoke at asset management company Bernstein's annual Strategic Decisions Conference, addressing the trillion-dollar market opportunity in cloud and AI technologies (Kunert, 2022). This response was to a question regarding Watson – the firm's own supercomputer that could understand natural language and was trained to interpret vast amounts of information from sources such as Wikipedia, encyclopedias, dictionaries, religious texts, novels, and plays. Three technologies under the Watson brand included Watson Health, designed to make informed diagnostic and treatment decisions, Watson Order to automate order taking at drive-throughs like McDonald's, and Watson Ops to increase the efficiency of IT operations.

IBM, for years, had been dedicating research and development efforts to Natural Language Processing (NLP)– a branch of AI focused on how computers can process language like humans do (Gruetzemacher, 2022). Around 2007, IBM Research took on the challenge of building a computer capable of competing in real time at the level of human champions on the American TV quiz show, Jeopardy. After three years of intensive R&D by a 20-member core research team, Watson was implemented, that performed at the level of human experts in terms of confidence, precision, and speed. In 2011, the AI machine defeated the two most successful contestants in the show's history (IBM, n.d.). To capitalize on this capability, IBM established a new business division, "Watson Group," focused on developing and commercializing cognitive technologies.

With $1 billion investment, IBM set healthcare as the first target, a bold attempt to transform the sector through AI and innovation. 45% of medical practice was not based on best available evidence, and the rapid growth of information made it impossible for doctors to stay up-to-date (Chesbrough, 2020). IBM sized the global addressable market at $200 billion, with clients paying for new analytics solutions to improve care quality and delivery (Ross & Swetlitz, 2017). The demand drivers were data proliferation, cost pressures, and the shift of the US healthcare system to value-based reimbursement. The optimism was also shared by research and advisory firm Gartner, which predicted a large and expanding market for Watson-powered smart advisors by 2015 (Reuters, 2014). By 2016, IBM had invested heavily to build upon its edge, formed strategic partnerships with leading medical institutions, and made several acquisitions to the tune of $4 billion to obtain health data and complementary analytics capabilities (IBM, 2016). Investment bank Credit Agricole had predicted Watson-based systems to account for 12% of IBM's total revenue by 2018 (Reuters, 2014).

Watson for Oncology was the cancer segment and was initially trained to generate treatment recommendations for breast, colorectal, and lung cancers. It took only 40 seconds for the analysis of data and the generation of the suggestions. Studies showed a high level of concurrence between Watson's recommendations and the opinions of experts, while also significantly reducing the time needed for certain tasks like identifying suitable patients for clinical trials. STAT, a national publication specializing in investigative journalism in health, medicine, and science, reviewed Watson Health for Oncology. It praised it as a valuable tool in areas with limited access to specialists and as a second opinion to validate treatment plans. The publication noted that Watson excelled at processing vast medical research, linking gene mutations to a patient's genetic profile, and recommending treatments that physicians might overlook. Physicians at cancer centers were recognizing the potential of Watson:

> *"What I've learned so far is that whatever we thought about the potential of this cognitive computing system as a physician decision support tool is true."* Mark Kris, MD, Memorial Sloan Kettering Cancer Center

After these early gains, there were instances of Watson recommending erroneous and unsafe cancer treatments that invited criticism (Ross & Swetlitz, 2018). While generating $1 billion in annual revenue, the division remained unprofitable (Lombardo & Mathews, 2021). IBM was now at a pivotal point where it needed to make a crucial choice to drive growth. Arvind Krishna needed to decide whether to continue focusing on healthcare and leverage its data ownership and analytics expertise to steer the firm towards profitability. Alternatively, should he consider a strategic shift to a cross-industry platform or pursue a third option that converged the two approaches? Each of these choices had implications. Arvind Krishna's strategic dilemma was essentially between vertical and horizontal strategies for Watson's applications. Making the current vertical approach work would primarily require increasing the accuracy of the AI-enabled system and safety of its recommendations, but with a narrower market focus only on healthcare. In contrast, a horizontal approach would involve developing a versatile AI platform on which clients across industries can build AI-enabled applications, offering IBM broader reach and diversification but with less specialization. The convergence approach would involve building foundational platforms that manage data and workflows, along with specialized tools for healthcare sub-domains, all within a single interoperable environment (Alucozai, 2024).

# 2 IBM and AI

## 2.1 Impact of IBM in the Evolution of AI

IBM had been at the forefront of technological innovation. In 1959, the term "machine learning" was coined by Arthur Samuel, an IBM researcher, who defined it as "the field of study that gives computers the ability to learn without explicitly being programmed" (Brown, 2021). AI caught the attention of the public at large in 1997 when IBM's supercomputer Deep Blue defeated the then-reigning world chess champion, Garry Kasparov. Deep Blue could evaluate 200 million moves per second, demonstrating how technology can solve complex problems. The next milestone was reached in 2004 when IBM released Watson, then a room-sized supercomputer named after its first CEO, Thomas J. Watson Sr. Fast forward to 2011, Watson developed into a question-answering (QA) system that beat the two top-ranked humans in the game show Jeopardy. Within 3 seconds, Watson could interpret clues in the question, rank potential answers based on their accuracy, and make a response. It demonstrated the power of cognitive computing and received global recognition. As a thinking and reasoning system, Watson could comprehend natural language with an accuracy, scale, and speed that surpassed humans (High, 2012). The technologies used by such cognitive systems included machine learning, deep learning, natural language processing, and neural networks, among others. By 2017, IBM had over 4000 patents in AI and cognitive computing (IBM, 2017). Figure 1 below shows some significant milestones in the ongoing AI journey, with emphasis on IBM's contribution to the field.

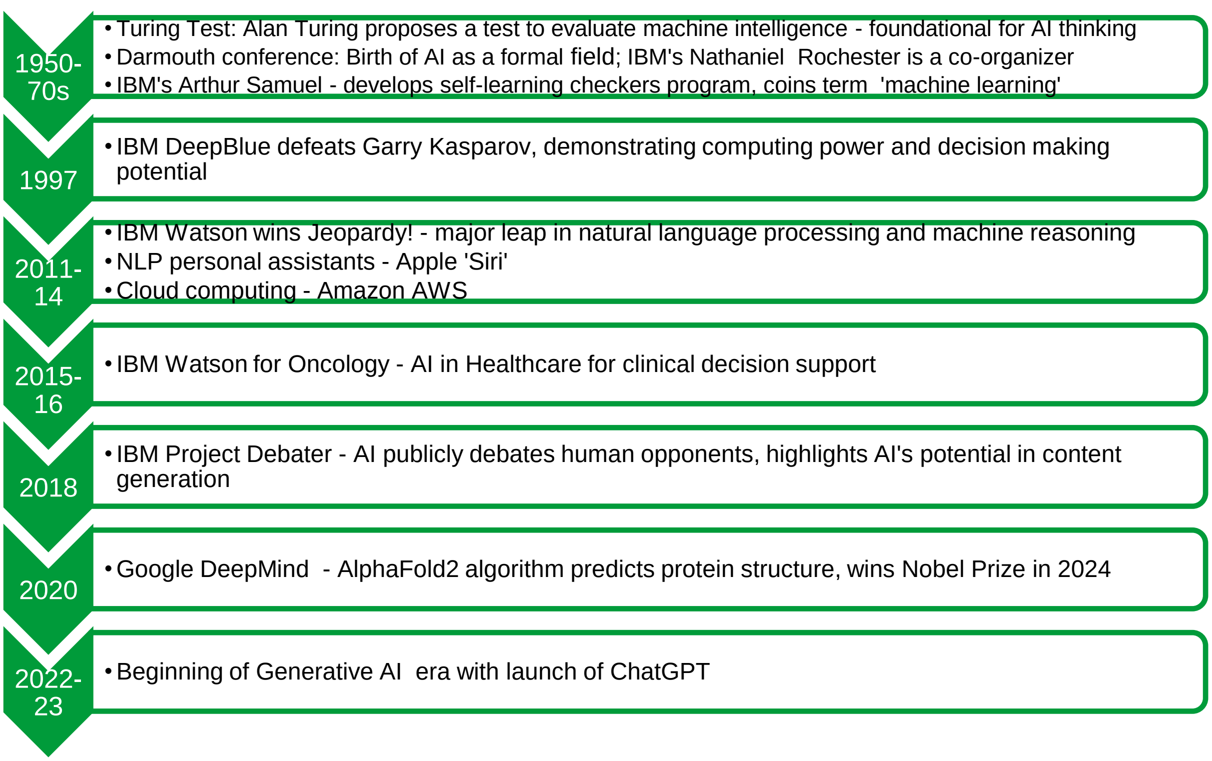


**Figure 1. AI Evolution and IBM (Source: Developed by Case Authors)**

## 2.2 AI Capabilities

AI has been defined in literature from multiple perspectives - as a concept, a field of study, as an ability, and as a system. AI artifacts possess four capabilities that are characteristic of human intelligence - perception of environment, comprehension of intention and context, taking action, and learning from experience. (Bawack et al., 2021; Almheiri et al., 2025). Comprehension and learning are unique capabilities that distinguish it from other technologies. Traditional software follows pre-programmed instructions, while AI systems learn from data, adapt continuously, and make decisions based on probabilities. With these capabilities, AI systems identify patterns and relationships in vast datasets that may be imperceptible to humans, make predictions, and improve their performance over time. These capabilities enable cognitive functions, such as problem-solving and decision-making, often at a scale and speed surpassing humans. In the healthcare domain, machine algorithms have been trained on large datasets of genetic data, medical images, and patient reports to detect patterns linked to diseases such as cancer and heart conditions. Continuous learning ensured the system was updated with the latest medical knowledge and emerging disease patterns, improving diagnostic accuracy over time. Their ability to predict the development of diseases and treatment outcomes enabled proactive interventions and personalized medicine.

Generative AI generates novel content, such as audio, code, images, text, and simulations. This capability stemmed from advancements in the deep learning class of algorithms and large language models (LLMs) in particular. Deep learning is an advanced class of machine learning, particularly suited to handle diverse data sources (text and unstructured data such as images), while requiring less human involvement and could often deliver more accurate results than traditional machine learning (McKinsey & Company, 2024). LLMs trained on massive datasets predict the next word in a sequence, enabling them to generate human-like text, translate languages, answer questions elaborately, and create original content. Thus, while traditional AI systems primarily produce analysis, predictions, or decisions based on input data, generative AI produces new data that did not exist before. This opened a wide range of applications. In healthcare, traditional AI analyzed existing datasets of molecules to predict drug efficacy. Generative AI could generate new molecular structures with desired properties. Thus, new drug candidates could be designed, accelerating drug development and discovering more effective treatments (Forbes Technology Council, 2023).

## 2.3 IBM Business Segments

IBM (International Business Machines Corp.) is an information technology company providing integrated solutions that leverage information technology and knowledge of business processes. The company was founded by Charles Ranlett Flint and Thomas J. Watson Sr. on June 16, 1911, and is headquartered in Armonk, NY. The divisions were Cognitive Solutions (now called Cloud & Cognitive Software), Global Business Services, Global Technology Services, Systems, and Global Financing. (Forbes, n.d.). Watson's revenues were included in the Cognitive Solutions unit and were also contributing to consulting revenue in Global Business Services (see Figure 2).

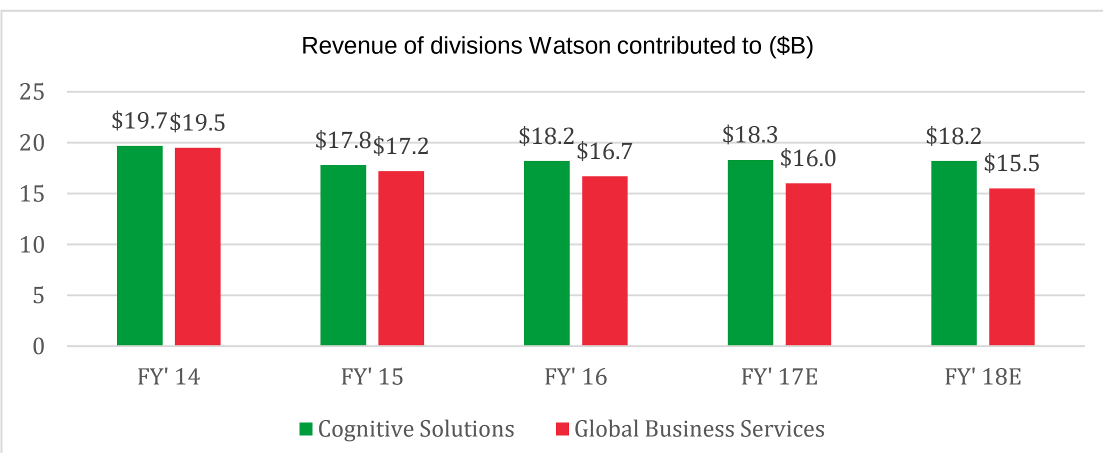


**Figure 2. Watson Revenue Divisions (Source: Kisner (2017))**

# 3 AI and Cancer

## 3.1 Healthcare AI

AI in medicine has been surging in recent years due to increased computing power, advanced algorithms, and data availability. The areas in which it had impacted included clinical decision-making, disease diagnosis, surgical practices, predictive medicine, and healthcare services management. Big data in different modes could be ingested, analyzed, and reported to detect diseases and aid clinical decisions (Secinaro et al., 2021). Predictive models were being developed to map common drug response pathways. Biological mechanisms could be better understood and predicted, patterns could be found in clinical and behavioral data, and the same could improve patient outcomes.

In 2020, Demis Hassabis and John Jumper from Google DeepMind developed an AI model, AlphaFold2, that solved a 50-year-old problem: predicting the complex 3D structure of proteins. The model successfully predicted the structure of practically all the 200 million proteins discovered by researchers. AlphaFold2 enabled new discoveries and scientific applications. The breakthrough demonstrated that AI was making science faster, helping to understand disease and develop therapeutics. Hassabis and Jumper were co-awarded the Nobel Prize for Chemistry in 2024 (Google DeepMind, 2024; Nobel Prize Outreach, 2024):

> *"One of the discoveries being recognized this year concerns the construction of spectacular proteins. The other is about fulfilling a 50-year-old dream: predicting protein structures from their amino acid sequences. Both of these discoveries open up vast possibilities. Life could not exist without proteins. That we can now predict protein structures and design our own proteins confers the greatest benefit to humankind."* Heiner Linke, Chair, Nobel Committee for Chemistry, 9 Oct 2024

## 3.2 Cancer Research, Detection, and Treatment

Medical judgment involves the synthesis of diverse data points to guide informed decisions. Cancer presented a unique context due to its many forms and the need to consider each patient's specific condition, ability to receive treatment, and individual response to treatment. Precision medicine was being viewed as a means to advance healthcare by tailoring diagnosis and treatment to each patient's unique genetic makeup (Harvard Business Review Analytic Services, 2018). Additionally, the body of cancer research literature was rapidly growing and evolving. These complexities challenged clinicians and researchers. The role of AI and machine learning offered two primary advantages – scaled-up information processing and more accurate clinical decision-making. With their ability to analyze vast datasets, AI systems could predict clinical outcomes by cross-referencing individual tumors to databases of unlimited comparable cases. Since the most common assessment method was visual evaluation, AI with its computer vision capabilities held promise in aiding clinicians in the initial interpretation of cancer imaging. Thus, the capabilities of AI offered the potential to enable complex diagnosis and therapy decisions, enhancing the expertise of clinicians.

AI methods were applied to increase knowledge about how cancer initiates, progresses, and spreads. The National Cancer Institute (NCI) researchers used AI to simulate the atomic behavior of the RAS protein, one of the most mutated cancer proteins (National Cancer Institute, n.d.). Research supported by NCI had shown that AI imaging algorithms could rapidly process mammograms to detect breast cancer better and predict the long-term risk of occurrence. AI could be used to investigate brain tumor tissues during a patient's surgery, which could accelerate treatment decisions (Vachon et al., 2023).

Algorithms could be developed to extract features of a tumor from unstructured clinical text automatically, saving thousands of hours of manual processing (Vachon et al., 2023). Patients living far from cancer specialists or where healthcare facilities were lacking could also access high-quality care with the help of AI tools like chatbots (Ayers et al., 2023; Görtz et al., 2023; Wang et al., 2023).

Thus, the opportunity set of AI applications in cancer included advancing knowledge of cancer biology, accelerating screening, detection, and diagnosis, expediting drug discovery, facilitating precision oncology treatment, enhancing the ongoing collection of cancer statistics, and democratizing access to cancer care. With AI capabilities, domain expertise, and access to healthcare data, organizations like IBM had the opportunity to tap into this large addressable market with potential for profit and social impact.

# 4 Watson Health – Entry into Healthcare

After proving Watson's analytics and NLP capability at Jeopardy, IBM began developing it as a problem-solving business tool that could interact with users in familiar language and process large amounts of data faster than humans. IBM formed the Watson Group in 2014 with an investment of over a billion dollars and 2000 employees in New York City (HPCwire Staff, 2014). Watson Health was launched in 2015 as a dedicated unit to build on its cognitive computing, analytics, security, and cloud strengths (IBM, 2015, April 13).

By 2016, the division had served five major segments: oncology, life sciences, population health, imaging, and payment/value. One of the key systems developed was "Watson for Oncology". It was trained by IBM AI engineers in a strategic collaboration with physicians at Memorial Sloan Kettering Cancer Center (MSKCC). Watson extracted clinical details from the patient's medical record, including gender, age, cancer type and stage, family history, prior visit notes, test results, and any coexisting conditions. The physician was then asked to review and confirm this information as well as add any relevant details. Watson, based on its training on over 300 medical journals and over 200 textbooks, predicted a prioritized list of treatment options and provided links to supporting evidence. Thus, Watson assisted oncologists in diagnosing cancer and making evidence-based treatment decisions.

Early studies demonstrated concurrence between Watson and actual treatment recommendations, along with process efficiency gains. The table below is a summary of its initial success (Cavallo, 2017).

**Table 1. Watson for Oncology's Success Rates (Source: Cavallo (2017))**

| | |
|---|---|
| Stage 1-III breast cancer (v/s MSKCC's recommendations) | >90% |
| Lung cancer (v/s MSKCC's recommendations) | 50% |
| Advanced lung cancer (v/s actually given treatments) | 88% |
| Tumor board (presented at American Society of Clinical Oncology ASCO) | 96% |
| Reduction in patient charts screening time for clinical trial eligibility | 78% |

Another system, "Watson for Genomics," was developed in a joint research effort with the University of North Carolina School of Medicine. This tool interpreted genomic data, was used to identify genetic mutations, and recommend treatment approaches informed by the latest research and clinical trials data. The other offerings were "Watson Care Manager", which assisted care managers in coordinating patient care, and "Watson Health Imaging", which was used to enhance medical imaging analysis. Overall, the dataset that Watson Health managed included 100M health records, 200M claims records, and 30B+ images (Ante, 2014).

# 5 Cognitive AI Technology Strategy

IBM's vision was that the decade of the 2020s would be the cognitive era, characterized by three trends: the cloud becoming the pervasive delivery platform, the need for cognitive insights into complex and unstructured data, and solutions tailored to industries. It had strategically invested in multiple high-potential areas to capitalize on these trends. The market opportunities included cognitive decision support, enterprise cloud, healthcare, internet of things (IoT), and financial services (see Figure 3).

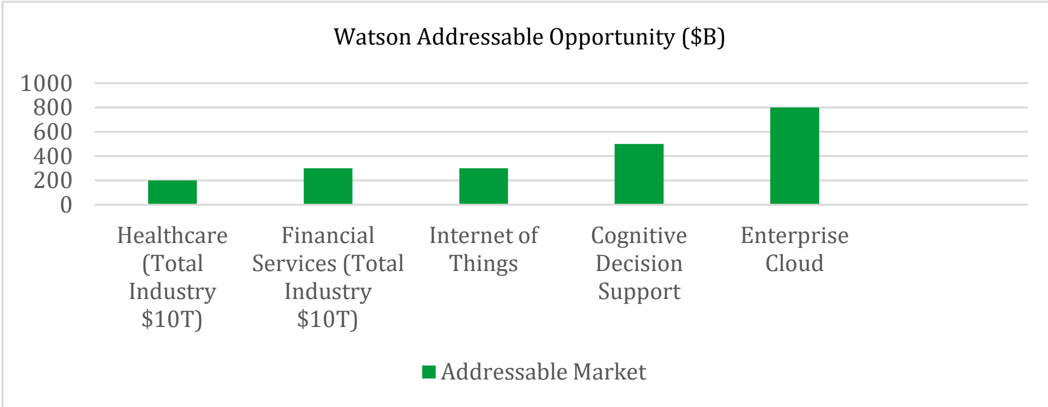


**Figure 3. Market Opportunities (Source: IBM Investor Briefing (IBM, 2017))**

## 5.1 Business Model and AI Strategy Components

In a recent business trends report, 85% of executives indicated that AI would enable innovation in business models, while 89% believed it would drive innovation in products and services (IBM Institute for Business Value, 2024, December 4). IBM recognized that as AI evolved into a transformative technology, it was also becoming increasingly tailored to specific industries and enterprise needs. 62% of the CEOs said that they have to rewrite organization playbooks (IBM Institute for Business Value, 2024, May 16). Watson Health's business goal was to effectively extract deeper insights from healthcare data and assist doctors in decision-making, leading to a differentiated offering and competitive advantage for IBM. IBM crafted its AI strategy for Watson to enable healthcare enterprises to reimagine their businesses and transform their operating models.

IBM promoted the Watson-as-a-Service model to meet the growing demand for cognitive computing. Watson-powered technologies were contracted to businesses and consumers via a cloud computing infrastructure. The CEO expected it to generate $10 billion in annual revenue in 10 years (Ante, 2014). The elements of the strategy that were designed to meet this goal included AI impact evaluation, forming strategic partnerships, implementing the all-important data strategy, building and deploying models, establishing governance mechanisms, and sourcing talent. Below describes the major components of the vertically integrated AI supply chain that implemented the strategy (Zhang et al., 2022).

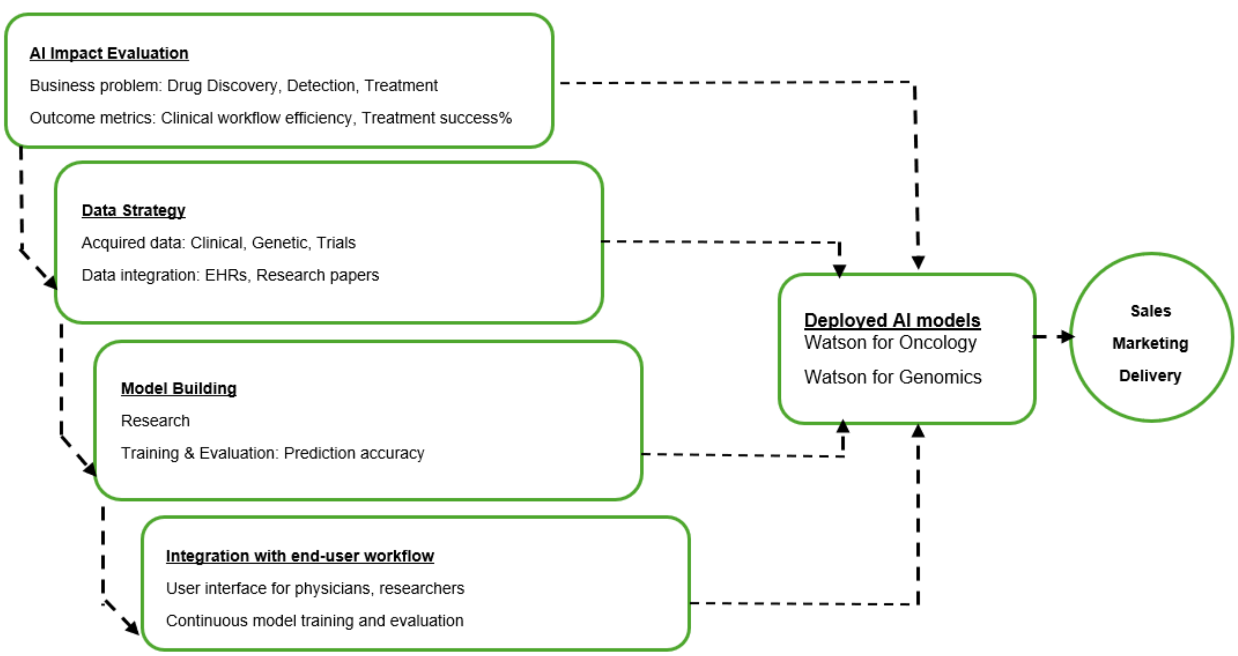

**Figure 4. Vertically Integrated AI (Developed and Adapted by Case Authors from Zhang et al. (2022))**

### 5.1.1 AI Impact Evaluation

Firstly, understanding the various AI technologies like machine learning, deep learning, natural language processing, computer vision, etc., was needed. IBM was a pioneer in these areas. Watson had already proven its analytics capabilities in natural language processing. Research was done to know where and how these technologies were being applied in relevant industries, what issues AI could address, the benefits gained, departments that could use it, their methods, and roadblocks.

It was important to be clear about what problems IBM was looking to solve, who would be the end customers (institutions, doctors, insurance companies, researchers), and what metrics needed to be improved. The division's objective was to enhance the innovation capacity of these customers by uncovering new insights from the vast and continuously growing volume of health data generated each day. It was the then-CEO Ginni Rometty's ambitious moonshot:

> *"I'm telling you, our moonshot will be the impact we will have on health care. It has already started. We will change and do our part to change the face of health care. I am absolutely positive about it. And that, to me, while we do many other things, that will be one of the most important."* (IBM, 2015, April 16)

Impact evaluation was part of the strategy design that included estimating patient-related or workflow efficiency related outcomes before building the model. It also included planning for unexpected issues that might arise after deployment into the business. So, when Watson for Oncology recommends treatments and the doctor chooses one, it should display outcome metrics like survival rates, materialized side effects, clinical workflow scale achievements, and other relevant desired parameters. This would help the doctor assess the treatment's overall efficacy and potential risks. The institution should be able to estimate the benefits of scale and return on investments targeted by the project.

### 5.1.2 Roadmap Building

IBM built a roadmap that prioritized early success and intended to bring value to the business. The datasets required to fuel the AI solution were to be determined. Machine learning models were to be designed, developed, and validated. The infrastructure where the Watson system had to be hosted was to be determined. Decisions had to be made between deploying it on its own infrastructure or third-party platforms. The former was preferred. The firm also had to assess whether its data scientists and developers had the necessary skills to implement the AI initiative instead of traditional software development projects. Skills would need to be developed internally through training where required. Tasks like deployment and operations capabilities were to be assessed (Finio & Downie, 2025).

### 5.1.3 Strategic Partnerships

AI solutions often require collaboration, customization, and a deep understanding of the client's needs. A primary advantage of strategic partnerships was the ability to adapt solutions to fit those needs. AI could be used to predict patient outcomes and improve treatment plans. This required a full spectrum of expertise – from medical data on one side to machine learning on the other (IBM, 2024). Partnerships could help implement models that enhance diagnostics and patient care.

IBM formed strategic partnerships with top healthcare providers and research institutes, including the Cleveland Clinic, the Mayo Clinic, MSKCC, the New York Genome Center, and the University of Texas MD Anderson Cancer Center, to advance Watson's capabilities. The University of Texas MD Anderson Cancer Center aimed to eradicate cancer. The vision was to leverage Watson to build a digital oncology expert named "AdvisorTM", which would help clinicians' surface valuable insights from the institution's extensive patient records and research repository. AdvisorTM would first analyze and link data-driven relationships between Watson's extensive corpus of published medical papers and other knowledge bases with patients' attributes. It would then offer personalized evidence-based treatment and management options to support the physician's decisions (MD Anderson Cancer Center, 2013). Co-developing clinically relevant, data-driven solutions with these institutions positioned Watson for broader market adoption and revenue generation.

Along with establishing Watson Health as a separate business, IBM entered into partnerships with Apple, Johnson & Johnson, and Medtronic. These companies were in the business of fitness, health, and medical devices that had data on which new health-based offerings could be built. The goal was to deliver deeper insights, real-time feedback, and recommendations that could achieve patient satisfaction metrics in all aspects of care – from personal wellness to management of acute and chronic conditions (IBM, 2015).

## 5.2 AI Strategy Implementation

The strategy implementation was essentially an industry-specific deployment that covered users' needs and end-to-end workflows. Data, algorithms, infrastructure, and talent had to be organized.

### 5.2.1 Data Strategy

Data was central to AI strategy, serving as the foundation for training, learning, and improving AI systems. It allowed AI to be personalized, was required for continuous model updates, and helped drive decisions. Data quality determined the accuracy and performance of the models. It had to be thoughtfully collected to minimize bias, and large volumes of data helped achieve scale. IBM took the acquisition route to get the required datasets and complementary analytics capabilities. It acquired four healthcare IT companies (Explorsys, Phytel, Merge, and Truven) in transactions exceeding $4 billion.

Explorys and Phytel were top healthcare software companies recognized for Big Data and analytics. Explorsys offered a secure cloud-based platform used by 26 leading healthcare systems to identify disease patterns, guide treatments, and track outcomes. The company was a spin-off from the Cleveland Clinic. It brought together clinical, financial, and operational information of 50 million unique patients, 360 hospitals, and more than 317,000 providers. A total of over 315 million data points was consolidated (IBM, 2015).

Truven was a leading solution provider of cloud-based healthcare data, analytics, and insights. It brought in more than 8500 clients, including US federal and state government agencies, employers, health plans, hospitals, clinicians, and life sciences companies. This made IBM's health cloud one of the world's largest repositories of health-related data, representing 300 million patient lives. (IBM, 2016).

Watson Health integrated its clinical decision support tool, 'IBM Micromedex', with 'Dynamed' from EBSCO Information Services. The solution suite combined drug and disease content into one unified source, providing evidence-based insights for clinical decision making (EBSCO Information Services, 2020). IBM worked with Mayo Clinic experts to broaden Watson Health's knowledge base by incorporating all clinical trials conducted at the hospital and those available in public repositories such as ClinicalTrials.gov. (Nellis, 2014). Doctors at Mayo Clinic trained the system on how to determine the best fit between a patient's specific health profile and the inclusion criteria of various clinical trials. Watson Health also collaborated with Cegedim Health Data to incorporate data from its 'THIN' system into IBM's real-world evidence solutions. 'THIN' was an extensive European database containing anonymized electronic health records (EHRs) dating back to 1994. This integration aimed to enrich IBM's data sets with longitudinal clinical information, supporting research and analytics (Cegedim Health Data, 2020).

Thus, healthcare data strategy involved full lifecycle management, including the generation, curation, aggregation, and maintenance of patient data that clinicians and patients use. Watson Health's integration with EBSCO's 'Dynamed', Cegedim 'THIN', Mayo Clinic's clinical trials database, and ClinicalTrials.gov database necessitated managing the data lifecycle to provide clinicians seamless access to evidence-based information for practical use.

### 5.2.2 Model Building and Integration with End-User Workflows

Model building involved algorithm training and evaluation, minimizing bias, improving prediction, and diagnostic accuracy. Watson Health was built using open-source software, but used its own algorithms. Its AI model was trained on tens of thousands of MSKCC's patient records and publicly available clinical research. In the initial days, it had analyzed 605,000 pieces of medical evidence, 2 million pages of text, 25,000 training cases, and was assisted by 14,700 clinician hours fine-tuning its decision accuracy (Upbin, 2013).

Productionizing AI requires inserting the model into the live software/hardware infrastructure that enables data ingestion, ensures computational power, provides an interface to a working model, and delivers insights back to users. The Watson Health workflow started with a medical professional submitting to the system a question, along with symptoms and other live information. Watson, with its medical knowledge and natural language processing capabilities, then mined the inputs provided and existing patient data to extract the important details such as family history, current medication, and test results. Putting this information together in perspective, the system generated hypotheses consisting of potential diagnoses with associated scores indicating correctness. Finally, it came up with treatment recommendations in three categories - Blue represented "Recommended with strong evidence supported", Orange represented "For consideration" with a potentially appropriate evidence-based alternative oncologists might recommend using their judgement and Red represented that is "Not recommended" treatment with contraindications or strong evidence against its use (Aggarwal & Madhukar, 2017) (Zou et al., 2020).

### 5.2.3 Governance

In addition to data and models, governance was another element of the framework that Arvind Krishna called the building blocks of AI (Furrier, 2024). Data security concerns and patient privacy breaches during the data exchange process could limit large-scale health data sharing. IBM Watson Health conducted joint research with the US FDA to define a secure, efficient, scalable health data exchange using blockchain technology. This initiative facilitated sharing oncology-related data from sources such as patient' electronic health records and wearables, while maintaining patient privacy and data integrity (IBM Newsroom, 2017). IBM also partnered with the Centers for Disease Control and Prevention (CDC) to research the potential benefits of blockchain in managing and securing healthcare data. This collaboration focused on leveraging blockchain's capabilities to provide a decentralized framework for data sharing, thereby enhancing the security and fluidity of data exchange in the healthcare ecosystem (Woodruff, 2017).

# 6 Challenges Facing Watson Healthcare

IBM's vertical strategy gave it complete control over marketing and sales, creating high expectations about Watson Health's capabilities. IBM was very focused on it in investor communications. Watson was mentioned 200 times in prepared remarks and earnings calls in the 2013-2017 period. IBM published more than 200 press releases featuring Watson in the headline (Ante, 2014). Watson Health was positioned as a revolutionary tool, but was not meeting performance expectations. Significant challenges began to present themselves. A gap between the promises and the actual utility of the system started to lead to customer disillusionment.

## 6.1 Model Accuracy

While useful as a training and academic resource, Watson was not proving to be advanced enough to operate independently of a doctor. Despite having advanced AI capabilities, the treatments suggested were often standard and known to oncologists. Several studies found mismatches between Watson and physician recommendations. For example, a study of 300 Chinese participants assessed the concurrence between oncologists and Watson for Oncology regarding cervical cancer treatment recommendations. 27% of the recommendations were mismatched, and most stemmed from patient preferences (Zou et al., 2020). In another study, only 24 of 50 thyroid cancer treatment methods matched those recommended by the system, with greater inconsistencies observed in more advanced cancer stages. This highlighted the precedence of a doctor's judgement over an AI system (Yun et al., 2021).

## 6.2 Algorithm Generalizability and Bias

With the training data primarily from MSKCC, reliance on a single source led to biases in the treatment recommendations, limiting its applicability to a broader patient population. AI bias refers to the occurrence of biased results due to human biases that skew the original training data or AI algorithm, leading to distorted outputs and potentially harmful outcomes (Holdsworth, 2023). Racial and socioeconomic biases were reinforced in healthcare outcomes (Goodwins, 2022). Watson was primarily trained on US patient data with treatments commonly prescribed in the US, but most of the hospitals using it were outside the US. Also, the model training used insufficient and synthetic data instead of actual patients (Schmidt, 2017). Therefore, its recommendations were not generalizable to regional factors such as the relative popularity of medical treatments in different countries.

Watson Health collaborated with IBM Research to examine a cohort of women experiencing depression after childbirth and their usage of mental health services. They analyzed models and data for evidence of bias, aiming to develop methods to mitigate it. Their findings indicated that algorithmic bias could significantly disadvantage racial and ethnic minority groups (Park, 2021).

Given that medical knowledge is continuously evolving, AI systems like Watson need to be continuously updated. Watson struggled to account for nuances and patient-specific factors crucial in oncology. Its architecture was not fully equipped to incorporate context-specific expertise. It failed to adapt to the rapidly evolving field of cancer treatment using AI (Goodwins, 2022). The system sometimes made erroneous recommendations that questioned its reliability. While internal quality checks caught these, physicians' confidence was undermined and was hindering its adoption (Cavallo, 2019; Gorski, 2017).

## 6.3 Explainability

When Watson recommended a specific treatment, doctors were provided with journal articles supporting this recommendation. However, the STAT reviewer found that Watson did not use these journal articles to arrive at its decision. Instead, it auto-populated these articles after deciding on treatment recommendations based on its training by MSKCC doctors in similar cases. There were no novel insights or treatment options generated that could make it helpful in addressing complex cases (Cavallo, 2019) (Gorski, 2017).

Watson's cognitive capabilities were being expanded. However, the lack of Explainable AI (XAI, a set of processes and methods that allows human users to comprehend and trust the results and output created by machine learning algorithms (IBM, 2023) led to concerns about acceptance and trust. Researchers could not fully understand how trustworthy the AI predictions were. It was fuzzier to oncologists and patients. The stakeholders were unable to assess how the AI system arrived at its prediction, such as determining whether a biopsy was benign or cancerous. The lack of trustworthiness questioned the reliability of machine-based judgment (Hantel & Clancy, 2022). This black box problem also implied that an incorrect diagnosis or inappropriate treatment recommendation made the determination of responsibility complex. Establishing clear lines of accountability was crucial to ensure that individuals and IBM or the healthcare organization adopting the AI system, were held responsible for its actions.

## 6.4 Ethical Considerations

The ethical considerations of AI in medicine included patient autonomy, equity, privacy, and the integrity of the patient-oncologist relationship. A core principle of shared decision-making was especially important in this context. Medical decisions are shaped not only by clinical evidence but also by individual patient values and preferences. What constitutes the best treatment could vary between two patients with similar clinical situations. This complexity can increase where medical evidence is limited or when a patient refuses a treatment deemed necessary by the physician (McDougall, 2019).

As mentioned earlier, Watson for Oncology identified a ranked list of treatment options, prioritized by a specific objective: maximizing patient lifespan. However, the underlying value framework informing these rankings was not personalized to the individual patient but instead based on a generic and largely opaque set of assumptions. As an AI system recommending treatments, Watson presented a potential threat to shared decision-making. Patient values differed i.e., not everyone wanted longevity in their treatment choices. For example, one patient with a terminal illness might choose palliative care, while another in a similar condition might prefer to pursue an aggressive treatment such as chemotherapy. Watson was often perceived as a computer that figured out the correct answer rather than one that recommended treatment aligned with an individual patient's goals, values, and preferences (McDougall, 2019).

## 6.5 Scaling and Integration Challenges

Integrating Watson into the existing healthcare workflows was challenging (Goodwins, 2022; Gorski, 2017). A significant investment was required to customize and deploy Watson at individual institutions. Being tailored to MSKCC's practices also led to scalability issues due to the failure to incorporate local variations like drug availability, treatment norms, and regulatory environments. Low scalability led to high operational costs, which had to be passed on to healthcare providers. Institutions in low- and middle-income countries were finding it expensive.

These challenges surfaced in IBM's partnership with MD Anderson Cancer Center (Schmidt, 2017):

> The system struggled to process written case reports, doctors' notes, and other text-heavy medical content. Addressing data quality issues in unstructured formats proved more challenging for AI than expected. Requiring doctors to structure data was impractical, as it would detract from the time needed for quality patient attention and care.

- Medical diagnosis proved far more complex than Jeopardy! questions. Despite engineers' best efforts, Watson Health struggled to interpret medical language as effectively as humans. For instance, it failed to distinguish between "ALL" as acute lymphoblastic leukemia and "ALL" as shorthand for allergy, highlighting its inability to grasp the context in which medical jargon was used.
- The system lacked seamless integration with EHRs and could not automatically extract medical attributes buried within doctors' consultation notes.
- There was a lack of shared understanding of the meaning of the accuracy level. The lung cancer accuracy level was 90%. It was unclear whether 90% accuracy was for standard clinical scenarios or the difficult situations in which treatment decisions were unclear. The doctors expected the system to recommend treatments they may not have considered otherwise. Watson-assisted decisions should be able to delay disease progression and increase overall survival rates.

As a result, the project suffered from procurement problems, cost overruns, and delays. After spending 62 million dollars over 5 years, the center did not renew its contract with IBM (Schmidt, 2017).

The Watson for Genomics system also ran into difficulties. Oncologists over-optimistically assumed it was a machine that could answer anything. The engineers found the genetic data complex, but there were gaps. The technology was not mature enough to diagnose a complex condition like cancer. It was discontinued in 2020 (Lohr, 2022).

## 6.6 Adoption Barriers - Patient and Physician Perspectives

Researchers conducted focus group discussions with 46 patients to solicit their perceptions and preferences about Watson for Oncology. These patients had breast, colorectal, or lung cancer. Overall, the feedback indicated that they were interested in the system, saw its value, and were open to its use, provided it supported and did not replace doctor’s decision-making. However, they also raised a few concerns. These included strict measures to ensure data accuracy, completeness, maintenance, and privacy. Other concerns were doctors relying too much on AI, losing their independence, and weakening the doctor-patient relationship. These concerns were amplified by frequent media reports on the potential risks of AI and consumer privacy breaches. This study highlighted the need to address patients' perspectives to ensure the integration of Watson for Oncology into cancer care (Hamilton et al., 2019).

The market challenge was demonstrating a clear ROI since some benefits, such as improved patient outcomes, were indirect. There was resistance from clinicians to trust AI recommendations or fear that AI would take away their jobs (Caswell, 2023). Healthcare professionals lacked the technical expertise required to use and interpret AI tools. AI adoption also required a cultural shift within the organizations, which happens only slowly.

## 6.7 Shareholder Value Creation

Jeffries, a leading investment banking and capital markets firm, had conducted a scenario analysis to quantify whether IBM’s investment in Watson was creating shareholder value. The bear case, base case, and bull case assumed revenue to grow at a CAGR rate of 16%, 20% and 23% respectively, until 2030. The result of the analysis (see Table 1) was that IBM would barely recover its cost of capital in the base case and would destroy value in the bear case. Watson’s contribution to EPS was estimated to be only 3% in the base case. Only in the bull case would the net present value justify the large investment IBM was making in Watson, but still, the earnings per share (EPS) contribution was expected to be only 5% (Kisner, 2017).

**Table 2. Summary of assumptions and results of scenario analysis (Source: Kisner (2017))**

| 2016-2030 | Bear | Base | Bull |
|---|---|---|---|
| Divisional Revenue CAGR | 16% | 20% | 23% |
| Watson Revenue CAGR | 24% | 30% | 31% |
| Annual Investment ($M) | $1,500 | $1,000 | $750 |

| Discount Rate | 12% | 10% | 8% |
|---|---|---|---|
| NPV Cash Flow ($M) | ($5,023) | $25,924 | $55,353 |
| IRSS (through 2030) | -2% | 11% | 17% |
| Watson contribution to total EPS (2019) | 3.4% | 4% | 5.3% |

Below was the key takeaway from their research report, which recognized Watson's cognitive capabilities. However, it pointed out that gathering and curating data required significant consulting work. The report also noted that some companies like Amazon, had ten times higher job listings than IBM. This indicated IBM was losing the war for AI talent, which was crucial for growth using emerging technologies.

> *"Our checks suggest that while IBM offers one of the more mature cognitive computing platforms today, the hefty services component of many AI deployments will be a hindrance to adoption. We also believe IBM appears outgunned in the war for AI talent and will likely see increasing competition. Finally, our analysis suggests that the returns on IBM's investments aren't likely to be above the cost of capital. Reiterate Underperform."* James Kisner, David Wishnow, Timur Ivannikov - Jefferies LLC, July 2017

# 7 AI Strategy Dilemma

As the AI landscape expanded, organizations like IBM had to choose between two strategies to derive business value from the technology. The current strategy focuses on specialized and tailored tools for a specific industry. Acquiring healthcare technology companies provided Watson Health access to specialized analytics expertise, a vast health cloud data repository, and domain knowledge. Also, IBM managed everything from R&D to customer delivery without involving third-party system integrators or open-source design. This end-to-end control offered advantages like better insights, real-time feedback, and recommendations for improving personal health, wellness, and addressing acute or chronic care. However, it also presented significant challenges as described in the section above.

The running strategy had a specific focus, needed specialized algorithms and deep domain knowledge, offered pre-built immediate value for the client, and was designed to comply with industry-specific regulations. An alternative was not to build patient-facing tools or look to transform a particular industry, but create ubiquitous and generalized applications such as Open AI's ChatGPT or Google Gemini. It would have broader applicability, generalized algorithms and high scalability, and would be largely domain agnostic. Each of these strategies had its respective benefits and challenges.

## 7.1 Horizontal AI Strategy

While vertical AI tackles industry-specific opportunities, horizontal AI enhances common cross-functional processes that enable data-driven decision making. Horizontal AI is analogous to solving a mathematical problem or providing tools for problem-solving. Unlike IBM Watson Health, Google AI's strategy was horizontal. Google Cloud AI offered a range of tools and services that were flexible and adaptable to multiple industries and use cases (Google Cloud, n.d.-a). Below are some examples:

- APIs for language, speech, and text to extract insights from unstructured documents, convert speech to text, text to natural-sounding speech, and translate content
- A tool called Vertex AI for quickly prototyping and testing generative AI models
- A generative AI document summarization solution to extract text from PDFs and create a summary
- APIs for image and video to uncover insights from images, detect objects, and enable content discovery and engaging video experiences
- Conversational AI platform called Dialogflow to create natural and interactive conversational capabilities in web and mobile applications, bots, IVRs, etc.
- Contact Center AI to increase operational efficiency and personalize customer care.

## 7.2 Advantages of Horizontal AI Strategy

The horizontal strategy's key advantages were scalability, adaptability, and integration. Businesses could start with small AI projects and scale up as needed by leveraging the cloud infrastructure and tools. Additionally, the platform was adaptable, allowing companies to customize AI models to fit their unique requirements, regardless of industry. It also allowed integration with Google's other products and third-party tools, creating a comprehensive ecosystem. The platform supported various data sources and formats, making it easier for companies to harness their data for AI model building. Google also provided consulting services via a 2–3-program to help companies gain value from their AI initiatives. The experts worked with the companies to understand their business goals, assess their current AI capabilities, and deliver recommendations customized to their needs (Google Cloud, n.d.-b).

An alternative for Watson Health was to pivot to this horizontal strategy and build a generalized AI platform that serves multiple industries while offering healthcare solutions through a consulting-focused lens. The platform could provide foundational, advanced, and modular tools for data analysis, machine learning, and natural language processing. AI models pre-trained on diverse datasets could be leveraged to reduce the time and cost for businesses to adopt AI solutions (Kim, 2023; Vorhies, 2018).

Healthcare could remain the focus area, but framed within a consulting-driven approach. The horizontal platform could be customized for healthcare clients to deliver bespoke solutions, such as integrating AI into existing systems like EHR. It could provide analytical capabilities to healthcare professionals to support decision-making in diagnostics, treatment planning, and operations management.

The platform could also offer regulatory and data compliance expertise by providing consulting services to navigate healthcare regulations like HIPAA in the US or GDPR in Europe. Horizontal strategy could provide cross-industry data synergies. Predictive accuracy and adaptability in healthcare applications could be enhanced by aggregating data and insights across industries. Offerings could be diversified by partnering with startups, universities, and industry leaders across verticals. A generalized platform deployed across multiple sectors would enable scale and reduce reliance on narrow revenue streams.

## 7.3 Business Model

IBM could evolve Watson into an enterprise-level platform for building and deploying AI services, equipped with the necessary APIs, models, tools, and environments for integration into applications. The model building platform could be cloud-based and be used by businesses across different industries in their respective core processes. For example, in retail, personalized marketing, inventory management, and customer experience enhancement; in finance, risk assessment, fraud detection, and algorithmic trading; in healthcare, predictive analytics, patient care optimization, and medical research; in manufacturing, predictive maintenance, quality control, and supply chain optimization; in media & entertainment, content recommendation, audience analysis, and automated content creation.

The revenue streams could include subscriptions to access the platform, consulting and implementation services, embedding Watson into third-party applications, or cross-selling with other IBM software. The value proposition needed would be access to open and proprietary foundation AI models, enterprise-grade AI governance, security, and compliance and AI that integrates deeply with enterprise workflows. The potential customers would be large enterprises across industries, government and public sector institutions, global system integrators, and software vendors.

## 7.4 Challenges with Horizontal AI Strategy

A challenge with horizontal AI would be not owning the client's core problem. It could become just a toolkit that must be adapted by consultants with industry expertise, or worse, require the client to invest time to learn about AI. There would not be any data defensibility since the company would not own the training data unique to a healthcare provider. The data would be in large volumes and diverse, thus requiring maintenance of quality. Platforms would need tools to clean, organize, and standardize data effectively to ensure accurate AI model outputs. Also, there would not be any defensible IP in a proprietary AI algorithm that cannot be easily replicated (Vorhies, 2018).

Training and deploying models on such horizontal platforms required extensive computational resources like GPUs and cloud infrastructure. This could be cost and resource intensive, especially for smaller companies. The pre-built tools and models on the platform could be difficult to customize to specific business needs. Skilled personnel would be required to tailor models effectively, creating barriers for those with limited expertise. Scalability to handle increased data and complexity could be a challenge as AI projects grow. If the platforms operate in siloed environments, it would be difficult to integrate with existing systems or collaborate across different tools (IBM, 2024; Erickson, 2024).

## 8 Decision Time

Another AI innovation under the Watson umbrella, 'Watson Orders', employed a similar strategy in another vertical - its partnership with McDonald's to develop and test AI-powered drive-through automated order taking (AOT) at 100+ drive-throughs across the US. The system did not achieve a high level of accuracy. It made ordering mistakes, which frustrated customers. Videos of the AI misinterpreting an order totaling up to 260 Chicken nuggets went viral. It recommended incorrect combinations, like adding bacon to ice cream. There were issues with interpreting different dialects and accents. Overall, the accuracy was not close to the desired 95%. The following comment about IBM technology from BTIG analyst Peter Saleh summed up the challenge (Feiner, 2024):

> *"Accuracy is the most important thing right now; it will have to be at least 95% accurate and will have to save franchisees money over having a person in the drive through, and the way it is designed now does neither."*

Given IBM's multiple setbacks with Watson Health and others like Watson Orders not delivering on AI's potential either, Arvind Krishna would have to make a strategic decision. Succeeding in the current vertical strategy would require continued investment in AI research to increase the system's cancer diagnosis and treatment recommendation accuracy to nearly 100%. AI models needed to be improved to handle unstructured medical diagnosis data, reduce diagnostic errors, detect and reduce algorithmic bias (Park, 2021), and enable trustworthy treatment decision-making. Deeper innovation would be required to make the models explainable for gaining clinician trust, streamline workflows that cut costs, build systems that are designed to adhere to privacy laws and ethical guidelines, and design scalable solutions that could adapt to various healthcare settings. The go-to-market field force would need to consist of healthcare practitioners to build clinical domain expertise directly or through deeper strategic partnerships with healthcare institutions. Around the same time, other technology firms were also looking to grab a piece of the healthcare vertical pie through acquisitions. Oracle corporation acquired Cerner Corporation, a top provider of digital health information systems, paying about $28.3 billion in equity value, $95 per share (Oracle Corporation, 2021).

> *"Healthcare is the largest and most important vertical market in the world—$3.8 trillion last year in the United States alone. Oracle's revenue growth rate has already been increasing this year—Cerner will be a huge additional revenue growth engine for years to come as we expand its business into many more countries throughout the world."* Safra Catz, CEO, Oracle

Companies were looking for user-friendly building blocks that they could use to introduce AI into their business models. Thus, an alternative for IBM was a platform strategy, which would involve creating a general-purpose AI platform adaptable across various domains, including healthcare. Arvind Krishna could consider switching towards this horizontal approach by positioning Watson as a development studio for companies to build, tune, implement, and scale machine-learning models. The current monolithic and closed AI system would have to be converted to an open, modular platform. The business model shift would include a change from use-case specific solutions to horizontal, flexible AI platforms, from black-box AI to explainable, governed AI, and from service-heavy engagements to a platform-first approach with strong consulting support.

The tools on the platform would need to be designed to integrate easily into horizontal areas like customer care, procurement, cybersecurity, supply chain, and IT operations. Given the rapid advancements in AI technologies, IBM would need to build a toolkit that unleashes the full power of generative AI in customers' core workflows to drive productivity. The platform should enable non-technology customers to efficiently build, launch, and oversee AI applications at scale. This would include automating and simplifying business and customer-facing processes. Technology companies should be able to boost productivity and productionize applications faster by integrating AI throughout the development lifecycle.

IBM had already well understood the importance of the issues of trust and governance. All industries should be able to use Watson to prepare and manage reliable data, helping improve the accuracy and usefulness of AI. The platform should also automate governance to manage AI risks, make it easier to comply with regulations and support responsible and transparent AI workflows. However, this product-to-platform shift could weaken IBM Watson's focus on the healthcare sector and strain its resources in redesigning the system. Navigating away from its moonshot ambition to revolutionize healthcare could lead to Watson being dubbed a failed prodigy and harm IBM's history of leading innovation.

A third option could be the convergence of the vertical and the horizontal. New levels of innovation could be unlocked by combining industry-specific insights with cross-functional capabilities in a unified technological framework. If IBM could fix the problems with Watson Health systems, it could consider integrating its AI-powered diagnostic accuracy with horizontal capabilities such as patient management systems and electronic health records. A generalized platform could streamline workflows, automate data cleaning, transform raw unstructured data into easily accessible formats while specialized tools could enable accurate treatment recommendations, drug discovery, and genomics (Alucozai, 2024). Resolving this three-way conundrum was pivotal to Watson's future. Arvind Krishna needed to evaluate its strengths using a resource-based lens to identify how they could be used to build a competitive advantage.

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