Data Analytics and the Fatal Flaws of Boeing's 737 Max: A Crisis in the Aviation Industry

Introduction:

Most firms today are preparing for a digital transformation journey with the primary goal of becoming more data-driven. Although the results are encouraging, analytics or AI adoption may take longer. As a result, many analytics projects and startups ultimately fail due to pressure. One of the instances is the failed project; the accidents of Boeing's 737 Max aircraft in 2018 and 2019 were tragic occurrences that rocked the aviation sector and claimed 346 lives. The crashes were brought on by a defective automated system that made judgments using data analytics, highlighting the potential dangers of depending too heavily on technology and automation in crucial fields like aviation. The incident also brought to light the significance of oversight and ethical considerations in the design and implementation of data analytics platforms. In this research, the causes, and effects of the 737 Max disasters will be investigated, along with how data analytics contributed to the creation of the defective system and how the incident affected Boeing, the aviation sector, and public safety.

Background:

The 737 Max, a new version of Boeing's well-known 737 aircraft series, was unveiled in 2017. The 737 Max was created to use less fuel and have a greater range than earlier versions. The Manoeuvring Characteristics Augmentation System (MCAS), a new automated technology designed to increase the 737 Max's stability and minimize stalling, was one of its standout features. Yet just a few months after the 737 Max was released, there were two catastrophic disasters that happened close together. All 189 passengers and crew members were killed when Lion Air Flight 610 crashed in Indonesian waters in October 2018. Then in March 2019, Ethiopian Airlines Flight 302, which had 157 passengers on board, crashed shortly after take-off.

Investigators discovered that the failing sensor that caused the MCAS system to constantly push the plane's nose lower and ultimately cause the accidents was to blame for the incidents. The study also showed that Boeing had not effectively trained pilots to bypass the MCAS system or alerted them of its existence. Boeing suffered enormous financial losses as a result of the 737 Max disasters, and the aviation industry experienced a crisis of trust. The event prompted concerns over the use of data analytics in the creation of vital systems as well as the significance of ethical issues in the use of technology.

Literature:

Data are incredibly important in the age of digitization. In order to accomplish corporate objectives, it passes through several stages during its existence, starting with identification and ending with analysis. Each stage has unique significance and traits.

1. **Discovery Phase:** This is the project's early phase. At this phase, the major goal is to comprehend and investigate the business challenge while defining the data's purpose and how to fulfill it. We do research on various types of data sources that are available and necessary for the project. The conceptualization of the business challenge and the creation of early testable hypotheses are crucial steps in this phase.

2. **Data Preparation:** The longest and most time-consuming process is this one. The focus of experts shifts from business needs to information requirements at this phase. Before proceeding to the following step, this phase entails gathering, processing, and conditioning the data. obtaining data from multiple data sources, then evaluating the quantity and type of data you can get in a specific amount of time. The process involves setting up an analytical sandbox, which the team then performs while loading, cleaning, and using the appropriate transformations.

3. **Model Planning:** In this phase, we evaluate the data's quality and locate a model that works for your project. Analysts choose the approaches, procedures, and processes they want to use for the next stage of model construction. The team makes reference to theories created in the early phases when they were only getting to know data and comprehending business difficulties. Some could move straight to model construction after skipping this phase. Yet, there is still more data exploration that must be done. To assist select the models that are appropriate for the projects, further investigation should concentrate on relationships between variables.

4. **Model Building:** Creating data sets for testing, training, and production reasons is part of this lifecycle stage. This procedure involves deploying the prepared model in a real-time setting. For developing and using the model, the team makes use of a number of methodologies and statistical modelling tools. Also, they do a preliminary test of the model to see if it correlates with the datasets.

5. **Communication:** Consultation with the pertinent stakeholders is the initial step in this procedure to determine if the results are successful or not.

6. **Operation:** Before putting the project live for users, the team installs a pilot project and publishes the project's results more widely.

What went wrong and why was the project abandoned?

Due to the company's excessive dependence on data analytics in its design and implementation, the Boeing 737 Max project was a severe failure. The automatic system of the aircraft, referred to as the Manoeuvring Characteristics Augmentation System (MCAS), depended on information from a single angle of attack sensor to make crucial judgments regarding the location and altitude of the aircraft. Inadequate pilot training on the system reinforced this problem, which resulted in the two deadly crashes in 2018 and 2019.

One of the key problems was the Federal Aviation Agency and Boeing's lack of openness and communication. The FAA relied on Boeing to self-certify the safety of the 737 Max and assigned Boeing a large portion of the duty for doing so. Due to Boeing's desire to outdo rival Airbus, the 737 Max was pushed to market as rapidly as possible, creating a conflict of interest. In the end, the 737 Max project's failure resulted in substantial changes in the aviation sector, including a closer examination of the certification procedures for aircraft and a shift in how producers interact with regulatory bodies. Also, Boeing suffered substantial financial setbacks and brand harm, leading to the resignation of the CEO of the business.

Based on the reports, the causes of project failure can be grouped into three broad categories:

Project Planning:

The Boeing 737 Max project was unsuccessful for a number of reasons, and poor project planning was one of them. In order to compete with competitor Airbus, the business hurried the construction of the aircraft, which resulted in inadequate planning and testing. The design process reportedly moved quickly since the development team was under a lot of pressure to achieve strict deadlines. To build the automated system, the team largely depended on computer simulations, which led to an overreliance on software and a lack of redundancy in case of failure.

Moreover, there were disruptions in the communication between several Boeing divisions, which prevented proper coordination and control of the project. A lack of monitoring and responsibility may

have been a result of problems with the certification procedure, where the Federal Aviation Administration (FAA) handed over part of its duties to Boeing staff. Consequently, it is reasonable to claim that inadequate project planning contributed significantly to the Boeing 737 Max project's failure.

Producers and directors of the strategy spent little time speaking with important partners since they were rushing to win awards for the show, therefore they were unable to handle categorization issues. also directly addressed the execution interaction.

As a result, the following is true:

- Unrealistic timeframe.
- Insufficient time for user interaction and privacy campaigns.
- Failure to compare achievement to goals.
- Failure of the system test.

Design:

The new Manoeuvring Characteristics Augmentation System (MCAS) of the aircraft was created to stop the plane from stalling in particular flying circumstances. Nevertheless, the MCAS was dependent on information from a single sensor, which was prone to errors and failures. Due to the system's frequent activations brought on by this design error, the plane's nose descended, which rendered the pilots helpless.

The MCAS was further created to run automatically without the pilots' awareness, which results in a lack of transparency and control. The pilot training and instructions did not fully explain the technology, which also contributed to the crashes. The Boeing 737 Max project's design failure emphasizes the value of thoroughly testing and evaluating new technologies in aviation, especially in safety-critical domains like flight control. In order to correct the weaknesses and assure safety, the business has now made considerable adjustments to the aircraft's design and systems. These changes include increasing pilot training and providing redundancy to crucial sensors.

The public authority is too aggressive, disregarding what this would entail for customer satisfaction and categorization, in order to save expenses and ensure swift implementation at the local level. We chose a centralized model that is challenging to operate.

As a result, the following is true:

- Ignore the risks and obstacles associated with large-scale IT initiatives.
- Ignore how the project is implemented as it is nearly inevitable that innovations will outpace the project.
- Pure ambition.
- The challenge is enormous for the initiative.
- A skilful problem in handling secrecy.

Culture change and Skills:

The Boeing 737 Max dilemma was largely caused by a failure to alter the culture and develop the necessary capabilities. The automated flight control system's development and certification were rushed due to the company's philosophy of putting profits above safety. Also, crucial information was overlooked or neglected because of poor communication and coordination between several teams, including those in charge of building the system and those in charge of training pilots.

Boeing should concentrate on establishing a culture of safety and putting it ahead of revenues in order to stop similar errors from happening in the future. To make sure that they have the abilities essential to create and deploy reliable systems, the organization must also invest in improving the skills of its personnel involved in data analytics, design, and project management. This might entail investing in continuous training and education programs as well as reassessing the organizational structure to encourage improved teamwork and communication. Future crises resembling this one might result from failure to solve these problems.

Boeing demanded a defined path, a project the load up, and a leave system, implying that the inevitable failures of pursuing such a vigorous program swiftly converted into structurally wide-ranging dissatisfactions. Also, the culture of the Design department and government, in general, did not facilitate the early identification and rectification of significant or niche errors.

As a result, the following is true:

- Lack of clear leadership,
- inability to predict the project's location,
- failure to provide training,
- failure to convey the primary financial arrangement from the start,
- and lack of concern for privacy problems
- There are no backup plans or departure strategies.
- A deficiency in project management abilities
- A focus on cost rather than quality by the depository.

What could be done?

Understanding the problem:

The automated system of the Boeing 737 Max airplane, which depended on inaccurate sensor data, failed, which was the main cause of the catastrophe. Yet, there were significant problems with data analytics that also played a role in the catastrophe. Boeing and its contractors, in particular, did not secure sufficient approval from the FAA or the airlines that operated the aircraft and did not conduct adequate testing of the automated system using suitable data.

The use of a single sensor to calculate the aircraft's angle of attack was one of the main problems. The automated system only depended on this sensor, despite its recognized flaws and potential for inaccurate data. The system should have been thoroughly tested using data from a number of sensors by Boeing's engineers and data analysts, who might have found the problem before it resulted in a tragedy.

Boeing also failed to secure the necessary authorizations from the FAA and airlines to utilize the information gathered by the automated system. In addition to potentially identifying information on passengers and crew members, this data also contained sensitive information regarding the operation and performance of the aircraft. Without the right authorizations and protections in place, this data might have been abused or treated improperly, endangering the privacy of the persons.

Overall, the Boeing 737 Max crisis highlights the importance of ethical data practices and responsible data analytics. Companies must ensure that they are using appropriate data and obtaining proper permissions and safeguards to protect individual’s privacy and safety. Failure to do so can have serious consequences, both for the individuals affected and for the company's reputation and bottom line.

Stakeholder responsibility:

The Boeing 737 Max problem is another illustration of an analytics project that was poorly designed in terms of stakeholder expectations and team resources. The original goal of the project was to modernize the current Boeing 737 model in order to increase fuel economy and lower operational expenses. The deployment of an automated system to aid pilots in managing the aircraft, however, was added to the project's scope. Stakeholders, such as the airlines that operated the aircraft and the pilots who would be utilizing the new system, were not fully informed of this increase in the project's scope. Because of this, they were not fully aware of the new system's potential vulnerabilities, particularly its reliance on a single malfunctioning sensor. The crew also had a limited number of resources at its disposal because they had to create the new aircraft type swiftly and cheaply. This resulted in a lack of thorough testing in real-world settings and the use of improper data in the creation and testing of the automated system. The Boeing 737 Max dilemma serves as a reminder of the significance of effective planning and communication in analytics initiatives. To guarantee that the finished product fulfills the needs of all parties involved, stakeholder expectations and resources must be precisely established and maintained throughout the project lifecycle. Failing to do so may have severe implications, such as loss of life, reputational harm, and monetary loss.

Start deferred to run speedily later:

Some suggestions

- Provide a more thorough examination of the organizational and cultural aspects that may have influenced the poor judgment and supervision that resulted in the 737 Max disasters.
- Examine how the Boeing 737 Max issue may affect the wider aviation sector, taking into account the effect on airline safety standards, governmental monitoring, and public confidence in air travel.
- Examine the moral ramifications of utilizing automated systems and data analytics in industries where safety is a top priority, such as aviation, and look into prevention measures.
- Examine how data analytics and machine learning may be used to enhance aviation safety, as well as the advantages and disadvantages of employing these tools to support or supplant human decision-making.
- Analyse the impact of the modifications Boeing and the aviation sector made in reaction to the 737 Max disaster, and consider any extra steps that may be required to prevent future occurrences.

Multisourcing:

Diversify data sources: Boeing might have analyzed and tested its automated system using a wide variety of data sources. Boeing could have used data from numerous sources to verify accuracy and completeness rather than relying primarily on data from one provider.

Collaborate with multiple vendors: Boeing might have analyzed and tested its automated system using a wide variety of data sources. Boeing could have used data from numerous sources to verify accuracy and completeness rather than relying primarily on data from one provider.

Ensure vendor accountability: It's critical to establish each vendor's duties in detail and maintain accountability while working with several providers. To make sure that each vendor fulfilled their obligations, Boeing might have created clear channels of communication and documentation. Monitor

and manage vendor relationships: Actively managing vendor relationships is crucial for the success of multisourcing. This entails evaluating vendor performance on a regular basis, expressing expectations and comments, and handling any problems or difficulties that may come up.

Build a strong internal team: Since multisource might be challenging, it calls for excellent project management and coordination abilities. Building a strong internal team to manage the multisourcing process and guarantee that all suppliers were cooperating successfully would have been advantageous for Boeing.

Changing risk and grant:

There are several suggestions for the Boing project:

Reassess the risk management process: It is crucial to recognize possible hazards connected to the project and put mitigation measures in place. This can include including several levels of safety safeguards and redundancy mechanisms in the design.

Implement a more rigorous grant process: A thorough examination of the project outline and design as well as a complete evaluation of the data analytics and automation systems should all be part of the grant application process. This will guarantee that before the project is authorized, all risks and possible problems are recognized and handled.

Regularly review and update risk management plans: The risk management strategies should be evaluated and revised as the project moves forward to account for any alterations or newly discovered concerns. This will make it easier to guarantee that the project stays on course and that any problems are resolved quickly.

Involve stakeholders in the risk management process: Stakeholder participation in the risk management process may assist in identifying possible hazards and creating workable solutions to minimize them, including regulators, consumers, and workers.
Adopt a culture of safety:

At the company, a culture of safety should be promoted where everyone prioritizes safety above everything else. A method for reporting and addressing safety problems may be part of this, as can consistent safety training, clear communication of safety regulations, and so on.

Conclusion:

The catastrophic faults in the Boeing 737 Max revealed how crucially important it is for the aviation sector to employ data analytics responsibly. A culture that prioritizes safety over profit must be used in conjunction with automated technologies and machine-learning algorithms in aircraft design and operation. The Boeing incident showed that failing to take such precautions might have terrible results, including fatalities, harm to the company's brand, and major financial and legal implications. To protect the safety of passengers and crew, the aviation sector must emphasize appropriate data analytics practices as it develops and adopts new technology. In addition to the technical issues with the MCAS system, there were also human factors involved in the two crashes. For example, pilots in both incidents may have been insufficiently trained on how to handle the situation when the MCAS system malfunctioned. There were also reports of cultural issues within Boeing, where employees were under pressure to meet aggressive production schedules and may have cut corners or failed to report safety concerns.

The tragedy emphasizes the value of a robust safety culture within aviation businesses as well as the necessity of continual training and assistance for pilots. Following the incidents, the Federal Aviation

Administration (FAA) and other international aviation regulatory agencies developed stricter guidelines for pilot education and MCAS system testing. The issue also emphasizes the requirement for broader viewpoints and contributions in the planning and creation of complex systems.

The event calls into question wider moral and social issues about the use of technology and automation in contemporary society, as well as the advantages and disadvantages of depending on data analytics and algorithms in high-stakes settings like aviation. Moreover, it emphasizes the need for accountability and transparency in the use of data analytics as well as the necessity of clear stakeholder communication and knowledge of the dangers and restrictions of these technologies.

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