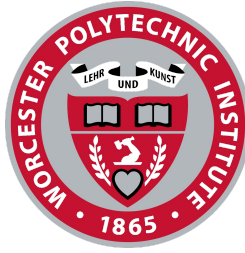# MIS584 - Final Project

Tesla Still Going Strong!

Team 9: Chandra Rachabathuni, Aviv Nur, Leena Kalia, Onkar Yelam

Executive Summary

With all the controversies swirling around in the public eye, Tesla needs to get ahead of the game and show its investors and the world that Tesla is still going strong. Our goal is to help Tesla do just that through the **transparent, ethical,** and **analytically sound use of BI**. For valid security and privacy concerns, Tesla does not ever expose the data it collects to the outside world. Therefore, we are proposing a stand-alone, end-to-end solution using **only externally available data** that anyone can verify and analyze themselves to show the following:

1) Tesla vehicles, including the controversial feature of autopilot, are as safe as, if not safer than, any other automobile or Electric Vehicle (EV) out there, and

2) Despite any and all controversies, Tesla sales and stock **have not been affected,** and Tesla executives have full confidence in the direction Tesla is going.

In order to do that, we have created two dashboards and a forecasting tool that will allow executives, investors, and marketing to monitor and prove with unassailable data that Tesla is still going strong!

Introduction

Tesla Company Background:

Founded in the year 2003, Tesla, Inc. is a renowned automotive and energy industry company. Headquartered in Austin, TX, it is globally recognized for its electric vehicles, battery storage solutions, and solar energy products. As of 2022, Tesla has approximately 127,855 employees and serves a global market that includes North America, Europe, Asia, and other countries. [1]

Current Status of BI:

Tesla is known as a data-driven company and, based on the details of various job postings [2][3][4][5], employs BI analysts from Junior to Senior positions in various departments who use tools such as Microsoft Excel, SQL, Python, and R for analysis and reporting, to visualize data in Tableau, Power BI and Streamlit. Data engineers collect and process the data in SQL, Kafka, and Spark. Tesla does NOT sell its data and, therefore has no need to develop the infrastructure to do so, but is likely in the Adult/Sage stage of the BI Maturity Model.

Related Case Studies:

As a data-driven organization, Tesla understands the value of BI and has no need of convincing of its value. Nevertheless, we are including two case studies as examples of how a BI solution such as ours can add value to the company.

Mazda Case Study: Transforming Customer Experience

Tesla is technically renowned as an auto manufacturer, so we present a BI case study involving Mazda [6]:

Mazda, renowned for its superior automobiles, also places great emphasis on delivering superb customer service. Their North American Operations division aimed to enhance efficiency and manage expenses by internalizing their call center operations. They required a cloud-based solution to utilize their current Microsoft 365 investments, duplicate existing functionalities, link with their CRM platform, and accommodate future omnichannel development.

The combination of Anywhere365's Dialogue Cloud and Dialogue Studio offered an ideal solution. This technology enables staff to engage with clients through several channels, regardless of their location. Dialogue Studio's data-driven routing provides effective customer support, while its interaction with Microsoft technologies such as SharePoint and Power BI allows for important data analysis and operational optimization.

What is the outcome? Mazda achieved a cost savings of $1.8 million and also enabled its staff to provide a broader selection of digital communication choices, resulting in a customer experience that is more focused on human interaction.

Microsoft and Johnson Controls: Building a Smarter Future

Since Tesla functions more like a Tech company, we've also examined a BI case study involving Microsoft. Just as Tesla is facing auto, tech, and environmental regulation, Microsoft faced environmental regulation in China and used BI to help meet its goals [7]:

Microsoft collaborated with Johnson Controls, a prominent provider of intelligent and eco-friendly building technologies, to renovate its Beijing Campus in support of China's ambitious environmental objectives. The project entailed the integration of Johnson Controls' OpenBlue Enterprise Manager (OBEM) and Metasys Building Automation System (BAS) with the current infrastructure. This facilitated instantaneous data analysis and enhancement of construction operations.

The outcomes are remarkable. The campus has successfully attained a notable 27.9% decrease in energy usage, showcasing the considerable capacity of smart building technologies to greatly enhance sustainability. In addition, Microsoft has experienced a decrease in the hazards associated with field operations, an enhancement in staff comfort, and an increase in equipment uptime, surpassing 98%. The case study showcases the impactful partnership between Microsoft and Johnson Controls, which is leading the road toward a more environmentally friendly future.

Proposed BI Solution

Business intelligence (BI) is a technology-driven process for analyzing data and delivering actionable information that helps executives, managers, and workers make informed business decisions. In our case, it will help in monitoring vehicle safety standards, including autopilot, and provide high-level company performance to executives and investors [8].

The general BI framework has the following basic components that encompass the functionality required on most current-generation BI systems.

- **ETL tools**
  Extraction, Transformation, and Load or ETL tools collect, filter, merge, and summarize data from external and internal sources before storing it in a specially designed data store to aid in decision-making processes. Internal data is generated by the company during its day-to-day operations, such as vehicle sales, supply chain information of parts and components, and inventory details. External data sources provide data that cannot be found within the company but is relevant to the business, such as the current price of company stock [9][10][11][12], accident data involving Tesla cars [13][14], and other automotive companies' data (competitors) [15]. Such data is generally located in external databases provided by industry groups, government organizations, or companies that market the data. We will provide the ETL to gather, clean, and store the external data needed for this project.

- **Data Store**
  The Business Intelligence (or BI) data store component is where an organization's raw data is kept. It includes databases, data warehouses, and other kinds of data storage facilities. These are collected from a range of internal and external sources. The data store component plays a key role in BI as it serves as the foundation for analysis, reporting, and decision-making. To protect the privacy of Tesla's data, we propose only using externally accessible data and establishing an independent data warehouse/data mart. We

suggest using a SQL relational database, consistent with Tesla's current infrastructure. The following is a proposed diagram of the required database layout.

dim_insider

PK	employee_id
	employee_lname
	employee_fname
	employee_role

fct_dji_auto_index

PK/FK	yyyymmdd
	price
	open
	high
	low
	volume
	prct_chg

fct_tesla_stock_price

PK/FK	yyyymmdd
	open
	high
	low
	close
	volume

fct_ndxt_tech_index

PK/FK	yyyymmdd
	close
	open
	high
	low

fct_insider_trades

PK	trade_id
FK	employee_id
FK	yyyymmdd
	trade_date_time
	trade_type
	price_per_share
	num_shares
	total_value
	curr_insider_total_shares
	cyclists_ped_deaths
FK	sec_form4_file_date

fct_tesla_accidents

PK	case_num
FK	yyyymmdd
FK	cont_country_state_code
FK	model_id
	incident_date_time
	incident_description
	equipment_problems
	injury_severity
	total_deaths
	tesla_driver_death
	tesla_occupant_deaths
	other_vehicle_deaths
	cyclists_ped_deaths
	autopilot_involved
	autopilot_claimed
	verified_tesla_autopilot_death

fct_reviews

PK	review_id
FK	yyyymmdd
	review_date_time
FK	model_id
	review_title
	review
	rating

dim_date

PK	yyyymmdd
	day_in_week
	day_in_month
	day_in_year
	day_name
	week_in_year
	month_in_year
	month_name
	year

dim_model

PK	model_id
FK	model_yr
	model
	model_description

dim_continent_country

PK	cont_country_state_code
	state
	country
	continent

fct_ev_title_registration_activity

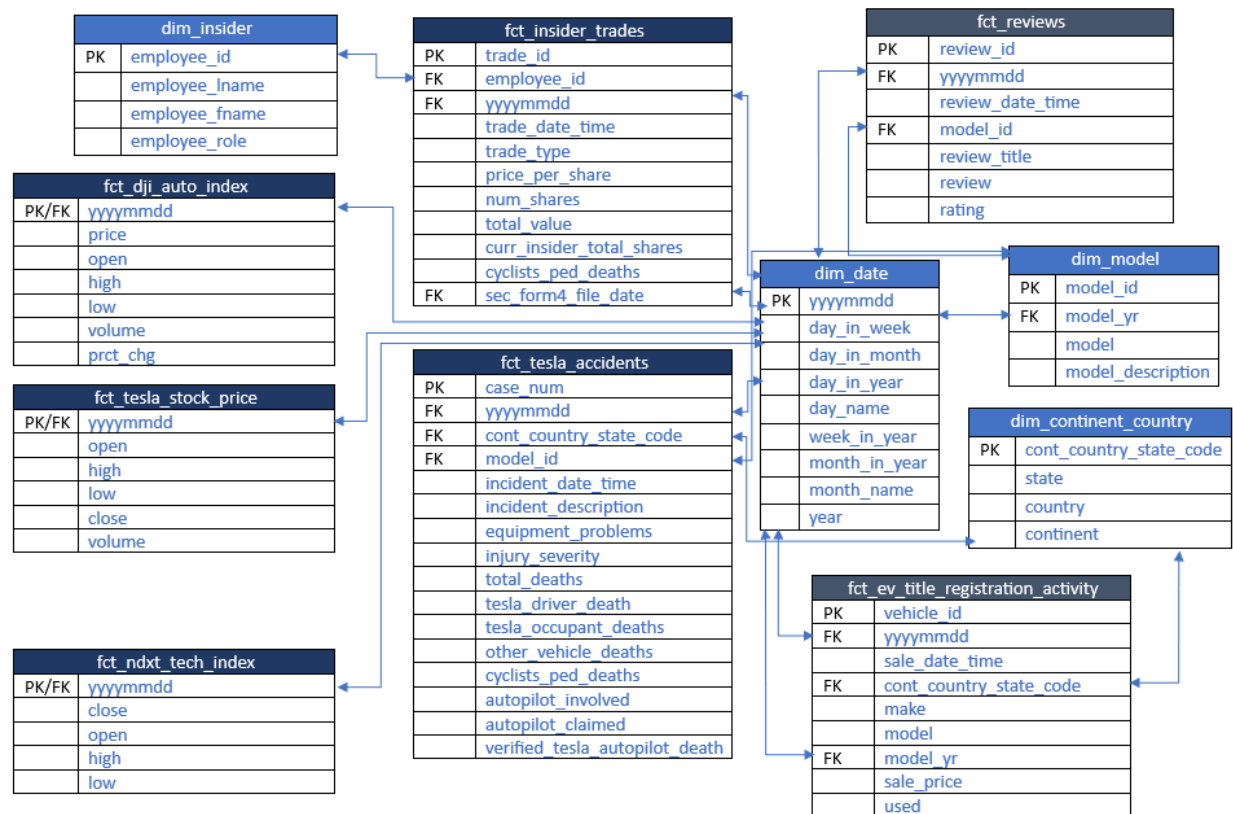|	
PK	vehicle_id
FK	yyyymmdd
	sale_date_time
FK	cont_country_state_code
	make
	model
FK	model_yr
	sale_price
	used

Figure 1. Data Mart

- **Query and reporting**

  The data analyst uses this component to design queries that access the database and generate reports. It handles data retrieval and selection. The query and reporting tools connect to operational databases, or more widely, the data store, depending on how it is implemented. We will connect to our data store through Tableau, again consistent with the existing infrastructure at Tesla.

- **Data visualization**

  Business Intelligence (BI) greatly benefits from data visualization, which involves representing data in a visual or graphic manner. This visual analytics ability enables those making decisions to comprehend complex concepts more easily or identify new trends. Interactive visualization brings significant datasets together and simplifies the process of

gaining insights by letting users explore charts and graphs for more detailed data. Information is communicated through resources such as bar graphs, maps, text tables, treemaps, and packed bubbles. Again, we will use Tableau, consistent with existing infrastructure.

- **Data Monitoring and alerting**

  This component allows real-time monitoring of business activities. The BI system will present concise information in a single integrated view for the data analyst. This integrated view could include specific metrics about the system's performance or activities. We will provide a system to monitor the ETL processes and database/data mart that we are proposing.

- **Data Analytics**

  This component carries out data analysis and data-mining tasks utilizing the information stored in the data store. It guides the user in choosing the appropriate data analysis tool and in constructing a dependable business data model. Business models are produced by unique algorithms that recognize and improve comprehension of business scenarios and issues. We employ Tableau for both exploratory and predictive analytics in keeping with the existing infrastructure.

Three Use Cases/Prototypes

Dashboard 1:
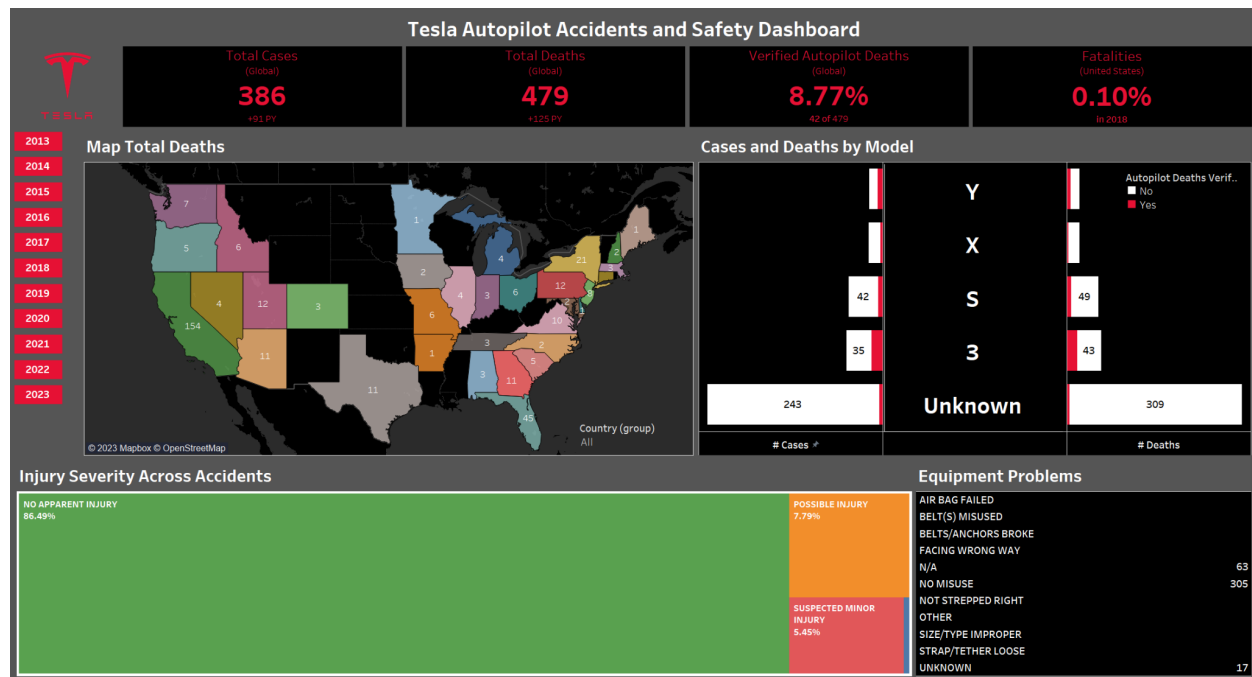
Figure 2. Tesla Autopilot Accidents and Safety Dashboard

The presented interactive dashboard provides a thorough summary of accidents involving Tesla, including the autopilot feature, that have occurred globally since 2013. The data [13][14] encompasses information regarding the overall number of instances, fatalities, confirmed Autopilot-related deaths, and their respective proportions across various countries and states. It provides a detailed breakdown with respect to specific models. Furthermore, it offers valuable information regarding the seriousness of accidents and accident-related equipment problems.

Applying year and model filters enables a more in-depth examination of trends and patterns. The screenshot shows that verified Autopilot deaths make up approximately 8.77% of all total deaths involving Tesla globally. Meanwhile, we can also see the 2018 fatality rate of 0.10% of all accidents in the United States indicates that Tesla's Autopilot feature is an insignificant factor:

2018 total Tesla deaths in the US / 2018 total fatalities in the US = 21/22404 = 0.000937 = 0.0937%

2018 Tesla autopilot deaths in the US /2018 total Tesla deaths in the US = 2/21 = 0.095 = 9.5%

2018 Tesla autopilot deaths in the US * 2018 total accident fatalities in the US

= 9.5% out of 0.09% = 0.009%
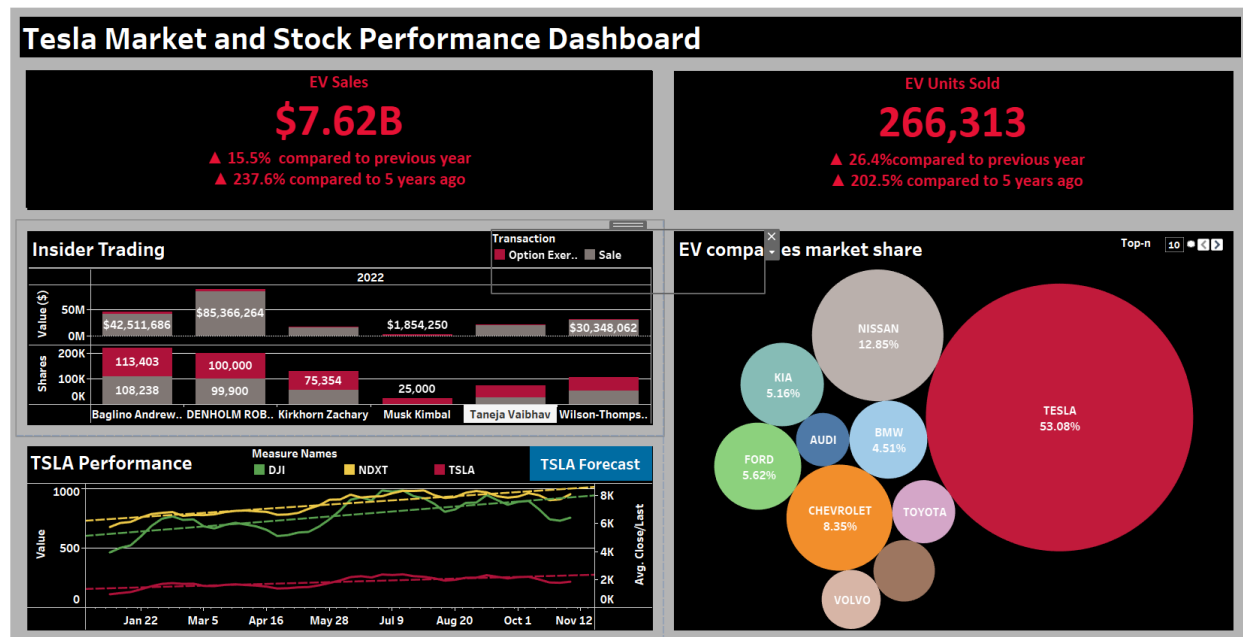
Dashboard 2:

Figure 3. Tesla Market and Stock Performance Dashboard

This dashboard is a financial strategic dashboard that demonstrates Tesla stock prices and market share are unaffected by the controversies swirling around in the public eye, and holding steady in comparison to other automakers and tech companies. It also demonstrates that Tesla insiders are maintaining their levels of stock ownership, not jumping ship. In addition, it gives an overview of how well the company is performing in terms of market share in the EV sector.

The initial focus is on two key performance indicators (KPIs) – Sales and Units sold. These metrics are analyzed in terms of their year-over-year and 5-year changes, offering a comprehensive view of Tesla's growth or decline. The "EV companies market share" section illustrates the market share of various companies in terms of sales, emphasizing Tesla's impressive 53% share in this competitive landscape.

A dedicated section on insider trading presents a chart depicting the executives' stock options exercised and the corresponding amount sold. This transparency offers a glimpse into the commitment of Tesla's leadership, as they are not hastily divesting their holdings.

The TSLA performance section compares Tesla's stock against the stock indices of both the tech and automotive sectors. Notably, TSLA appears less volatile compared to its

counterparts, demonstrating a more stable trajectory. This comparative analysis adds another layer to the overall evaluation of Tesla's financial standing and market positioning.
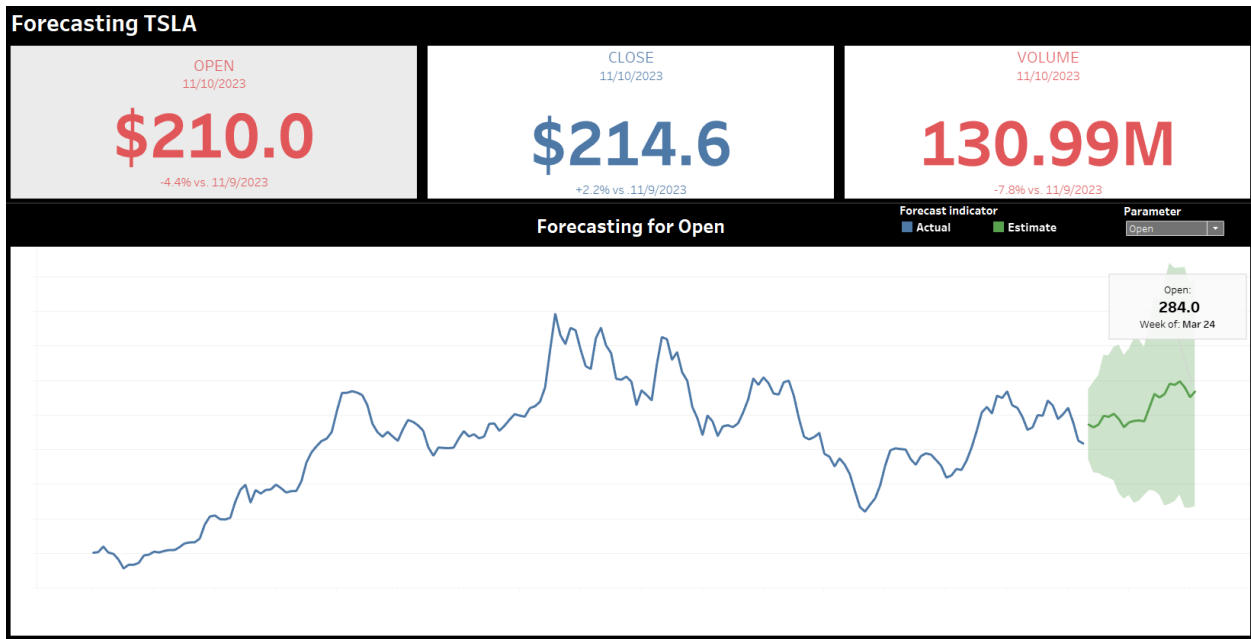
Forecasting Tool:

Figure 4. Forecasting TSLA Stock Historical Price

Using data from Yahoo Finance [11], we have created a predictive tool that forecasts the future movement of Tesla's stock price over a span of 22 weeks. This includes predictions for the opening and closing prices, as well as the trading volume. This interactive tool presents projected values for each indicator, along with the corresponding percentage change in comparison to the most recent data. The Tesla stock forecast dashboard indicates an expected upward trajectory, with a projected closing price of $283.0 on March 24, 2024. This projection suggests a potential increase of more than 30% from the current price of $214.60. These facts indicate that Tesla continues to be a dependable investment for individuals seeking sustained expansion over an extended period.

Implementation

In the dynamic realm of technology, firms must consistently adjust and develop in order to maintain their competitiveness. Given the issues Tesla is currently confronting in terms of autopilot safety, data collection, and AI regulation, it is imperative for the company to alter its approach to data analysis so as not to appear in any way unethical and to provide a measure of transparency. Kotter's eight-step change model provides a significant guide for effectively managing this shift and attaining sustainable success [16].

The following table (Table 1) presents a plan for Tesla to apply Kotter's eight phases in order to create and integrate a Business Intelligence (BI) solution that allows monitoring of controversial features such as autopilot, improves transparency, builds trust with investors, and boosts future financial performance.

Table 1. Kotter's eight steps to transform an organization

Steps	Tesla
Establish a sense of urgency	Tesla must show investors and the world that its financial performance is unaffected and going strong despite concerns with the safety of autopilot systems.
Form a powerful guiding coalition	Involve key stakeholders from Tesla's Managers, engineering, safety, and data science teams.
Create a vision	Define the vision of a BI solution that allows monitoring of Autopilot safety, enhances Tesla transparency, and promises future financial performance.
Communicate the vision	Communicate the vision and strategy to all stakeholders within Tesla.

Steps	Tesla
Empower others to act on the vision	Provide training, support, and collaboration to Tesla engineers on using the BI solution and sharing knowledge among different departments.
Plan for and create short-term wins	Prioritize the development of dashboard features that address market perception and safety concerns of the company.
Consolidate improvements and produce more change	Establish regular updates and continuous improvement and integrate the BI solution selectively into Tesla's standard operating systems.
Institutionalize the new approaches	Encourage open communication and collaboration around ethical data-driven decision-making.

Technical and Ethical Challenges:

Since our goal is to help Tesla maintain a strong positive image amid swirling controversy, we must ensure that everything we do is transparent and ethical. As described above, all the data we use is externally available so that anyone can verify and analyze it themselves. However, we need to go further to ensure everything we do is ethically sound. We propose implementing a framework for ethical decision-making similar to that outlined by the Markkula Center for Applied Ethics at Santa Clara University [17], which is designed to:

1) help users see and identify a broader set of ethical issues than they would have without it, and
2) guide users through a process that includes both pre-decision and post-decision steps. [18]

The process entails:

- Identifying the Ethical Issues
- Getting the Facts (including knowing who has a stake/will be impacted and how)
- Evaluating Alternative Actions
- Choosing an Option for Action and Testing It
- Implementing the Decision and Reflecting on the Outcome

We would certainly employ this framework in the implementation of our BI solution and we would encourage Tesla to consider employing this or a similar framework throughout the organization. With all the data Tesla collects and all the latest BI technology Tesla employs, especially AI, it becomes essential that Tesla does not, even "accidentally", run into ethical issues regarding that data and its use.
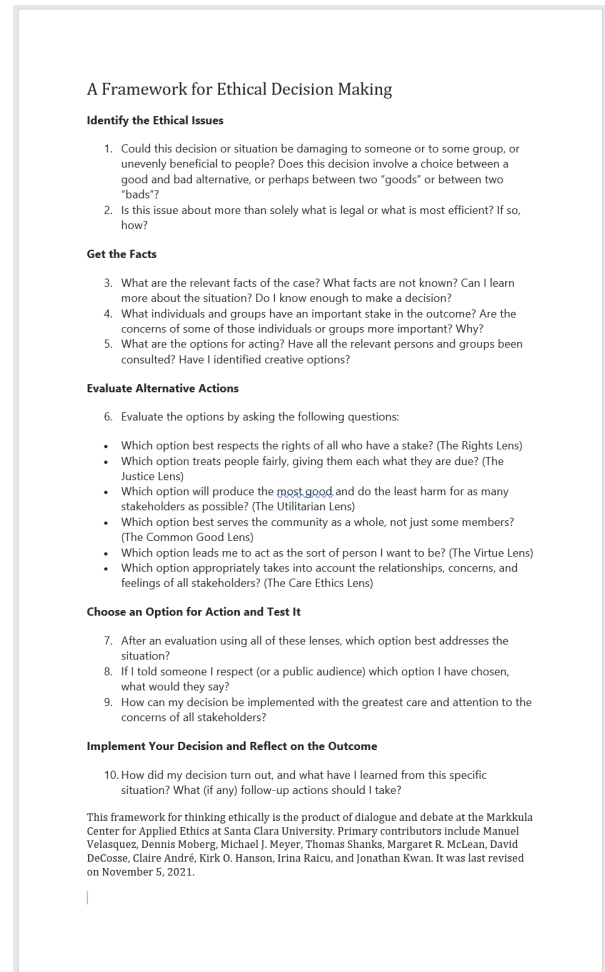

Figure 5. A Framework for Ethical Decision Making

Conclusion

We are proposing a stand-alone, end-to-end solution that is transparent and ethical to help Tesla prove to the public and its investors that Tesla is a safe and sound investment, both in terms of its vehicles and its stock, and that Tesla is still going strong!

Future projects:

1) Create new dashboards around new features/vehicles that come out e.g. Tesla has just introduced electric trucks that can supposedly haul larger loads.

2) Gather reviews on the latest new feature or product being rolled out and add the results of sentiment analysis to the dashboard to monitor customer reaction.

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