

ASSIGNMENT 1

1A) Evaluate and explain the main, overall corporate conflict that ultimately led to the ethical issues and outcomes of the case.

In 2007, Toyota Motor Corp. was the largest car manufacture in the world. In that same year, Volkswagen hired Martin Winterkorn as CEO. Martin Winterkorn wanted to produce more than 10 million cars per year to become the largest car manufacturer in the world [1]. To do this, Volkswagen had to triple their car sales. In 2007, the price of fuel had continued to rise from previous years, due to the rise in cost per barrel of oil. The national average of gasoline in December was \$2.97 [4]. The company could choose to do a hybrid engine or diesel. Both are very efficient to relieve the cost of fuel.

Diesel has a lot of benefits as well as many significant challenges. One of the challenges of a diesel is the amount of nitrogen oxides (NO_x). Without emission controls, diesels let out the famous black smoke, soot, which also has a lot of carbon. This is because diesels are not like gasoline where it has octane. Diesel is a thicker fuel. The engines are also called “oil burners”. To regulate the amount of soot emitting from the engines, emission systems are installed in the engine. These include EGR, Engine Gas Recirculation, a mechanical means to extract exhaust to burn again, since some fuel remains in the air. Engine Control Units are electronic means to determine oxygen levels for fuel injectors. Many different systems on the engine can reduce the amount of emissions of a diesel. However, emission controls on a diesel can hinder fuel efficiency and performance.

The United States has grown increasingly stricter with clean air emissions for passenger cars. The regulation for commercial vehicles is a lot looser. Most large commercial vehicles use diesel engines for their efficiency, basically the engine works (uses less rpm) than a gasoline engine, to haul large loads.

In 2007, Volkswagen held only 5% of the market in the U.S. for diesel engines [1]. Martin Winterkorn believed diesel engines could provide high efficiency without the sacrifice of performance [1]. To accomplish the goal of being the largest car manufacture in the world, Winterkorn decided not to use Daimler's BlueTec technology [1]. Thus, the company had to start from scratch. Engineers were faced with a difficult deadline to meet a difficult goal.

1B) Assess and summarize the one main corporate decision that led to the ethical issues and outcomes of the case.

Winterkorn's approach of an autocratic form of management drove engineers to make difficult decisions [1]. According to Luann J. Lynch, Professor of Business Administration at Almand R. Coleman, when the "dangerous triad" or "fraud triangle" exist, employees begin to make unethical decisions [1]. The "dangerous triad" includes pressure, opportunity, and rationalization. This "dangerous triad" existed at Volkswagen due to the autocratic style of management. Management was determined to meet the goals no matter the cost. Lynch explains pressure as autocratic leadership in addition to the consequence of failure for the German economy and the reputation around design and manufacturing

were substantial [1]. The housing crisis hit in 2008 causing even more pressure on the auto maker.

Bosch was the developer of the engine-management software. They sold their product to Volkswagen under the assumption the product would be used internally for testing. This software can determine when a vehicle is under the testing mode, by monitoring the number of wheels moving. If only 2 wheels are in motion, the vehicle would switch to testing mode, otherwise it would be in road mode. This was opportunity [1]. Rationalization stems from the 1970's when the company used "defeat devices" to cheat against emissions controls. The company was caught and subsequently fined only \$120,000, a very light consequence. When all three situations exist simultaneously, the company can then behave unethically.

1C) Investigate and outline the electronic technology at the core of the ethical issues of the case. Focus the discussions on the computer-related aspects of the technology. Identify the individual and his background/role who is considered to have been primarily and directly responsible for its development and implementation.

The electronic control unit (ECU) used in "dieselgate" was manufactured by Bosch. Bosch sold Volkswagen the device with the intentions to use for internal use [2]. This system detects the motion of the wheels to know when the car is in testing mode or road mode. Apparently, many manufactures have cheated emissions by monitoring the motion of the steering wheel, which tires are moving, or even the time the engine is operated. The

United States and European Union have two different test cycles. Interestingly, the United States operates the engine for exactly 11.04 miles. Depending on the region, the testing cycles are different. Cycles are defined as a route a driver takes. For example, start the engine when it is cold and take a few measurements. Then accelerate to a specific speed and hold that speed for a given set of miles. Meanwhile, take measurements. A next set of test includes starting the engine when it is hot and take a few measurements. The Engine Control Unit (ECU) made by Bosch will recognize all of these conditions.

Since the software of Bosch's ECU is proprietary, the following will be an explanation of a typical ECU. An internal combustion engine is basically a large air pump that powers itself [5]. To improve both efficiency and performance, the right amount of fuel is added to what the ECU reads in the exhaust, after the air has gone through the engine. Too much fuel and too little oxygen makes the combustion dirty and wastes fuel. Too much oxygen and not enough fuel makes the combustion slow and weak [5]. This delicate mixture is constantly updated to ensure efficiency and performance. There are several variables the ECU uses to control the correct mixture, fuel to air ratio, which include:

- Engine demand – difference between city and highway driving
- Engine coolant/temperature – prevents extreme heat or cold in the engine metals
- Air Temperature – air temp controls the amount of fuel used
- Fuel Temperature – prevent the fuel from igniting too early
- Fuel Quality – filter unwanted particles from the engine

- Varying Filter Restriction – flow of fuel to the injectors
- Air Pressure – Combustion requires a set air pressure
- Engine Pumping Efficiency – how well the air gets in and out of the engine

There is much more to the ECU controls [5]. With the Bosch ECU, there was over 100 million lines of code. The purpose of the ECU is to determine the condition in which the car is used and respond with the appropriate predetermined model for best emissions and performance.

James Robert Liang pleaded guilty to conspiracy to defraud the government, commit wire fraud and violate the Clean Air Act [6]. Liang had a pivotal role in the development of the EA 198 diesel engine, a 2.0L engine that was included in several VW and Audi models. Once the engineers knew they could not pass the emissions, the search for a “defeat device” began. Due to the pressure of succeed at all costs, this seemed to be a rational decision. In 2008, Liang began to help the US market with certification, testing, and warranty issues for the company [6]. The Bosch ECU has the capability for firmware upgrades. These images were uploaded to newer cars in the years 2009-2015 [6]. Liang was not the mastermind for the “defeat device” but played a key role in the scandal [7]. He was sentenced to 40 months of federal prison [7]. This scandal has cost Volkswagen approximately \$17 billion in civil suits and \$4.7 billion to settle criminal charges [7].

2). Based on the Volkswagen Code of Conduct:

a). Develop a table that lists all the key provisions from the Code that you believe are relevant to the issues of the case.

b). Be sure to clearly denote the sections and provisions of the code being identified.

c). Include columns that compare and summarize reflections about where the Volkswagen scandal disconnected with each of the listed provisions, from both a leadership and engineering aspect.

Section 2 - General Conduct Requirements	Provision - Responsibility for the Reputation of VWGoA
Leadership Aspect Summary - The provision states that the employees must exhibit the highest standards of integrity in design and development. Deviating from this by allowing employees to design and develop software that defeats emission testing puts into question the reputation of VWGoA (Company).	
Engineering Aspect Summary - Designing such software could also bring into question the employability of an engineer involved in this process. The provision states that employees should contact an appropriate authority when the propriety of an action is in question, which was not accomplished.	
Section 2 - General Conduct Requirements	Provision - Employees and Professional Development
Leadership Aspect Summary – With an autocratic style of employment the Company failed to provide its employees an environment where they can grow personally and professionally since cutting corners and deceit are commonly encouraged under this sort of system.	

Engineering Aspect Summary – The engineers involved in knowingly constructing the defeat software were not maintaining a high personal standard for themselves or their performance.	
Section 2 - General Conduct Requirements	Provision - Management Culture and Collaboration
Leadership Aspect Summary – Managers at the Company must ensure that unacceptable conduct and that no violations occur over their supervision. By rushing research and development management the employees were implicitly encouraged to forgo important safety procedures.	
Engineering Aspect Summary – An open line of communication is required of employees at the Company to inform management regarding the relevant facts of business for effective action and decision-making. Effective decision-making wasn't accomplished between management and employees.	
Section 3 - Avoiding Conflicts of Interest and Corruption	Provision - Combatting Corruption
Leadership Aspect Summary – The Company and its constituents are required not to distort competition. Advertising a product that purports to be environmentally friendly when it is not is deceptive to the public and competition and is a violation of this policy.	
Engineering Aspect Summary – Engineering employees contributing to the development and implementation of the defeat software are also directly contributing to the deception of product quality to the public and the Company's competition.	
Section 4. - Reporting Code Violation, Corruption and Conflicts of Interest	Provision - Questions About Possible Conflicts

Leadership Aspect Summary – Leadership failed to handle any questions of ethical concerns given the knowledge of the development of defeat software.	
Engineering Aspect Summary – Employees are required to contact appropriate supervision regarding any questions of ethical concern for a given situation, such as supervisors or human resources. This was not handled effectively.	
Section 6 - Treatment of Information	Provision – Reporting
Leadership Aspect Summary – The Company was criticized for taking a long time in releasing their documentation to the courts until they had conducted their own internal investigation, contradicting their code of conduct of timely reports, records, and statements.	
Engineering Aspect Summary – Using falsified emission reports in tandem with the defeat software is inaccurate and a violation of this provision.	
Section 8 - Environmental Protection	Provision - Environmental Protection
Leadership Aspect Summary – Leadership advertised a product that was supposed to be environmentally friendly. Allowing engineers to develop defeat software to bypass emissions safety test additionally violates the Company’s provision on manufacturing products that are ecologically efficient.	
Engineering Aspect Summary – Engineers are required to appropriately and economically utilize natural resources and that the decisions made have a minimal impact on the environment. Developing defeat software to bypass safety emissions testing is an admission in the Company not satisfying this provision.	
Section 10 - Handling the Code of Conduct	Provision - Implementation

Leadership Aspect Summary – By utilizing an autocratic system of growth in the Company employees are encouraged to take shortcuts in exchange of short-term gain. This gives employees who ardently follow the code of conduct a disadvantage in the corporate environment, a violation against this provision.

Engineering Aspect Summary – An engineer who hopes to rise in the ranks of the Company will be faced with a choice in ignoring important safety protocols in exchange for short term gains, or to do the best they can while following the code of conduct, putting them at a disadvantage with their peers.

3. Based on what you've learned, interpret, and discuss what you believe were the causes of corporate ethical issues at this scale.

There are several causes for the problems Volkswagen went through with “dieselgate”. First, is the autocratic style of leadership. This style put undue pressure on the employees, along with the housing crisis of 2008 which caused the world’s stock market to fall, which forced them to abide by the wishes of management to succeed at all cost. When a non-management employee is faced with a decision to “do this or we will find someone else” mentality. The dangerous triad of pressure, opportunity and rationalization were obviously present during this situation. Many people lost their jobs in 2008 stock market crash, so there was pressure to keep a job and just do what management said even though employees knew this was unethical. Opportunity arises when Bosch sold the ECU that allowed to switch modes from road to testing mode. Then there is rationalization. After making the wrong decisions to do whatever it takes to meet goals, people rationalize their

decisions to justify that they had no other choice. This is a devastating to both the employees and the company. Credibility and competency is lost with the engineering world.

Secondly, another issue that led to the large-scale ethical issues stem from Volkswagen's desire to become the largest car manufacturer in the world by increasing production to 10 million cars sold. To accomplish this, research and development were rushed in creating the new technology that would provide fuel efficiency without sacrificing performance. This, in tandem with an autocratic form of corporate oversight, encouraged engineers to proceed in deciding to bypass stringent U.S. emission law testing. A mitigation to preventing this situation from potentially rising again is to give the research and developers a generous timeline in developing technology, discouraging the desire to cut corners.

Thirdly, buying Bosch's ECU gave the company opportunity. By implementing this ECU into the car, it allowed Volkswagen to cheat the emissions tests in the United States and in Europe. Reverse engineering the ECU was not easy. Hidden in more than one hundred lines of code allowed Bosch to switch modes. After much investigation, it seems Volkswagen did not change the code in the ECU. There are reports that Bosch was involved in the scandal [3]. This is part of a slippery slope of events that seems to force the company's hand to make this decision. Past decisions to cheat the emissions in Europe have rationalized the notion that a slap on the wrist would be the consequence.

Fourthly, Volkswagen decided to not use BlueTec in treating diesel exhaust pollution, but to develop a new system that would be inexpensive. This would normally not be an issue (or even encouraged) but combined with the desire to become the largest car manufacturer in the world and advertising to the public of a green product led to a lot of pressure from the engineers to develop product better than BlueTec and less expensive in short timeframe. A mitigation to this would be either to set realistic goals in development or to continue using a product that's known to have at least some reliability to limit the pressure incurred on the engineers.

Lastly, Volkswagen had other options at the time, besides diesel. At the time, crude oil prices were on the rise. A barrel of oil was peaking over \$100 a barrel [4]. Building a car for the needs of a market is always the best situation. Since diesel was much more popular in Europe, at the time, in the United States, it accounted for about 3% of sales. Choosing a hybrid engine may have been a better route to take for the US market. Mostly light duty pickups and commercial vehicles have diesels because of the relaxed regulations.

4. Summarize recommendations that you believe would serve as preventive measures to avoid future crises of this nature.

There are several measures that could be implemented in future endeavors in order to avoid a similar situation as this from happening. Allowing engineers ample time to find a safe and efficient method being first and foremost. Deadlines for innovation, especially innovations involving public safety, should be goals - not concrete and forced. The methodology followed by management should be one that is encouraging productivity and not dollar signs.

Aside from easing the pressure of deadlines, remembering to prioritize the safety of the consumer is just as important. The priority for any engineers and their respective companies should be the quality of the product they are putting out. Doing so establishes a level of credibility that is difficult to earn again once it has been lost. If consumers feel they can trust the engineers behind the product they are investing in, the overall value of the product is automatically increased.

Additionally, ensuring that the product passes tests without controls is vital. In some cases, it's genuinely a matter of life or death - there aren't control variables in the real world, where the product is actually going to be utilized. Incompetent builds are simply unacceptable. Producing builds that do not switch modes from testing to road mode is vital.

Beyond the engineers' responsibilities, the company should adhere to more realistic expectations and something achievable. Allowing their workers to succeed and thrive by accomplishing amazing (yet realistic) feats will create a workforce that is more fulfilled and excited to work. Not only that, but the workers will believe in what they are producing and feel fully confident in standing behind their products. Essentially, enabling a positive workplace environment would be critical in avoiding unethical decisions that result in disastrous scandals such as 'dieselgate' from occurring.

Last but not least, a professional environment would be quite beneficial as well. Even if all of the above examples were to fail, if the staff involved were professional and responsible, they would be able to hear their engineers out when confronted with an

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unethical dilemma such as this. Instead of pushing for distribution to begin making profit,
further testing and improvements should've been in order, without question.

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TEAM 3 PEER AND SELF EVALUATION MATRIX

ASSIGNMENT 1	Stephen McDonald	Joshua Main-Smith	Jordan Roysdon	Troy Crawford	TASK MGR.(Y/N)
Stephen McDonald	100	100	100	100	Y
Joshua Main-Smith	100	100	100	100	N
Jordan Roysdon	100	100	100	100	N
Troy Crawford	100	100	100	100	N
	100	100	100	100	