Air Corporate Governance and Suspicion of Corruption in Supply Chain Management: The Case of Tunis Air Airlines

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Received May 05, 2023, **Accepted:** May 13, 2023, **Published Online:** Jun 30, 2023
Reviewers: Anonymous Peer Review
Citation: Lakhal, S. Y. & Lakhal, C. (2023). Air Corporate Governance and Suspicion of Corruption in Supply Chain Management: The Case of Tunis Air Airlines. *International Journal of Supply Chain Management, 12*(3), 64-72, https://doi.org/10.59160/ijscm.v12i3.6182

***Abstract*— The corporate governance of airlines companies is not a well studied area. As corruption is a criminal act, the issue is sensitive, and the doors are not opened for researchers. This article aims to contribute to the scarce literature surrounding this topic in order to overcome the lack of research. By staying studying this topic at a general lever and analyzing most of the supply chain activities of real airline companies, we can detect which activities within the supply chain present the most potential where corruption could take place. Propositions will be developed about the characteristics that need to be built into the value chain activities to be robust against corruption. These analyses and propositions are grounded in a case study of the Tunisian airline, Tunis Air. Although this company is not among the biggest airlines in the world, it's governance could be a structural example in this area of study.**

Keywords—*Governance, Corruption, Supply Chain, Value Chain, Airlines Industry.*

1. Introduction

Corporate governance is defined as the framework of rules and practices by which a board of directors ensures accountability, fairness, and transparency in a company's relationship with all its stakeholders (financiers, customers, management, employees, government, and the community).

The corporate governance framework consists of:

(1) Explicit and implicit contracts between the company and the stakeholders for distribution of responsibilities, rights, and rewards.
(2) Procedures for reconciling the sometimes-conflicting interests of stakeholders in accordance with their duties, privileges, and roles, and.
(3) Procedures for proper supervision, control, and information-flows to serve as a system of checks-and-balances [1].

Corruption is defined as: wrongdoing on the part of an authority or powerful party through means that are illegitimate, immoral, or incompatible with ethical standards. Corruption often results from patronage and is associated with bribery [2, 3]. If it is proved, it is considered a criminal act.

Assessing how the supply chain and the value chain activities are performed through the eyes of corporate governance, it is possible to detect the suspicious practices leading to potential corruption situations.

The airline supply chain is the entire network of activities, directly or indirectly interlinked and interdependent aiming to serve the passengers well. It comprises of vendors of aircrafts, the parts for the maintenance, the suppliers for the catering service to be offered to the passengers on board, aircrafts maintenance service providers, storage warehouses, parts for the maintenance, and partners that provide aircrafts to be rented if it needed. Supply chains underlie value-chains because, without them, no airline company can give customers what they want, when and where they want, at the price they want. Airlines companies compete only through their supply chains. No degree of improvement at the airlines company's end can make up for the deficiencies in a supply chain, which reduce the company's ability to compete.

This paper is organized as follows: Section 2 opens with a brief review of the available literature on the corporate governance applied to airlines companies. Some aspects of the potential corruption situations will be analyzed. Section 3 analysis the supply chain for an airline. Section 4 assesses the corruption risk through an airline supply chain. Section 5 presents and analysis the case of the Tunisian airline Tunisair in order to verify the proposal suggested. Section 6 offers concluding comments and guidelines for future research.

2. Literature review

In this section, we present some research findings relevant to our subject structured around five principles.

Principle 1: *where there is acquisition, there is possibility of corruption*

The corruption in the procurement contracts is the most common corruption. For example, every year, over 250,000 public authorities in the EU spend around 18% of GDP on the purchase of services, works and supplies [4].

Given this number, public procurement accounts for on average 29% of total general government expenditure in OECD countries (2013 data) (OECD, 2015), and closer to 50% of public pending in developing countries. Hence, these practices can cause serious damage to the economy and to public confidence in institutions. Favoritism in the allocation of contracts can lead to higher prices, reduced value for money, the provision of low-quality or unsafe works, goods and services, and reduced competition [5-8].

Principle 2: *the larger the amount of the acquisition, the higher the probability of corruption*

Many researchers studied corruption and procurement and some of their findings justify *Principle* 1 and 1.1. For example, Kohler and Dimancesco [9] studied public healthcare and found that, corruption in the procurement process does not appear to be limited to any one level of the organization or type of health system. Owusu, Chan et al. [10] examined the prevalence of corruption and the effectiveness of anti-corruption measures in the city and found that, regardless of how clean a city may appear to be, it can be tainted by the hidden forms of corruption regarding infrastructure projects involving a large amount of procurement. In the same vein, Sikka and Lehman [11] found, after studying corruption in government procurement programs that, a major reason for this perennial problem is the supply of corruption by corporations keen to secure lucrative contracts.

Principle 3: *in a corrupt environment, the procurement will cost more to the organization compared to a healthy environment*

This principle could be justified by the finding of Burguet and Che [12] who studied competitive procurement administered by a corrupt agent who is willing to manipulate his evaluation of contract proposals in exchange for bribes. They found that with complete information and no corruption, the efficient firm will win the contract for sure. If the agent is corrupt and has large manipulation power, bribery makes the contract costly because the efficient firm could not secure a sure win and it is more likely that it loses the contract. This last idea is well explained by Celentani and Ganuza [13] who investigate the effect of corruption on competition in procurement. Their assumption is that the agent that administers the market, if corrupt, may provide an opportunity for bid readjustments in exchange for a bribe. As firms expect to be paying a bribe, a mechanical effect of corruption is to increase the contract price by an amount corresponding to the anticipated bribe. They show that, a key effect of corruption is to facilitate collusion in price between firms and thereby to generate a price increase that goes far beyond the bribe received by the bureaucrat.

Principle 4: *Within a complex structure, corruption will likely involve a structured network from different departments and different organizations*

Hudon and Garzon [14] presented a comprehensive theoretical approach to study procurement corruption. This approach argues that corruption in public procurement can be explained by the creation and development of "corrupt procurement coalitions" (CPCs). Functioning as a network built by corruption entrepreneurs seeking to "milk" the procurement process, a CPC must accomplish three interrelated tasks to succeed: 1) identifying which members to include and organizing interactions of said members, 2) generating and redistributing benefits, and 3) evading internal and external control.

To reinforce the idea in principle 4 , we report the Lafayette scandal in the arms procurement studied by Willett [15] and Sung [16]. In which up to US$760 million in bribes and kickbacks was split among French, Chinese, and Taiwanese officials for the 1992 sale of French frigates to Taiwan. They demonstrate the existence of a network that used the structural and institutional deficiencies in Taiwan and France that to create opportunities for massive corruption.

Principle 5: *Corruption is always accompanied with red flags, if they are detected the corruption could be reduced or avoided.*

The determination of **indicators and red flags** that can help increase the detection of corruption, increase investigation effectiveness, and minimize corruption opportunities. [17] determined eight red flags (e.g. large tenders, lack of transparency, collusion of bidders, urgent orders) among 28 widely used to minimize the risk of various forms of economic misconduct, among which corruption in public procurement. For Bauhr, M., et al. [18] and after drawing on collected data of more than 3.5 million government contracts between 2006 and 2015, found that overall tender transparency in the bidding process reduces corruption risks substantially.

As Ferwerda, Deleanu et al. [17], Fazekas, Tóth et al. [19] developed a composite indicator (red flags) high-level institutionalized corruption through a novel Big Data approach to create a corruption indicator at contract level that can be aggregated to the level of individual organizations, sectors, regions, and countries. These red flags are: (1) not **publishing the call for tenders** in the official public procurement journal, as this makes it harder for non-connected competitors to prepare bids, (2) **Using less open and transparent procedure types** can indicate the deliberate limitation of competition, (3) A too-short **advertisement period** (number of days between publishing a tender and the submission deadline) can inhibit non-connected bidders in preparing adequate bids may also signal corruption risks, (4) Subjective, hard-to-quantify **evaluation criteria** (for example, the quality of company organigram) rather than quantitative or price-

related criteria allow rigged assessment procedures as they create room for discretion and limit accountability mechanisms, (5) If the **time used to decide on the submitted bids** is excessively short or lengthy, it can signal corruption risks. Snap decisions may reflect pre-mediated assessment, while long decision periods and a corresponding legal challenge suggest the outright violation of laws.

These five principles will guide our analysis to spot the risky activities in airline supply chains which be analyzed in the next section.

3. What is the Supply Chain for an Airline?

The airline industry is an extremely competitive market, there is little competition among its suppliers and among the most important products for an airline company is its aircrafts. In the large commercial aircraft market of the airline supply chain, the competition is characterized essentially by: (*i*) a duopoly: Airbus or Boeing. This duopoly has considerable power, and there is no possibility of any new suppliers entering the market in the near future for long commercial carrier aircrafts. (*ii*) An aircraft can operate for around 20 years and may change ownership several times. Some airlines look for the newest systems for a quality of services and prestige; others will tolerate a cheaper aircraft. A strategy might be to obtain a brand-new fleet, operate it for a while and then offload it before the first major engine rebuilds become due (at about the seven-year service) while another strategy might privilege in-house maintenance, repair and overhaul capability, thereby tolerating the increased frequency of servicing operations that older aircrafts require. (*iii*) Airliner assets are so expensive, putting a substantial barrier to market entry. For example, a new Boeing 737 has a theoretical list price between 85 and 130 US$90m depending on the model [20]. (*iv*) The much more challenging supply chain issue that must be addressed every day is that of supplying each flight**. (*v*)** An airline supply chain management is not to ensure goods that are available at the airline's own hub, but at every place that scheduled flights depart from, all over the world, in the right quantity, at the right time. The aviation business structure could be represented by Figure 1.

Figure 1: Typical aviation business structure

The activities related to these aviation organization structure:

Fleet

For an air company Management fleet (Acquisition and fleet planning with the coordination with the MRO) is a very important activity during the full exploitation and during the End-of-life cycle. Fleet management is generally separated from the Asset management (owned).

Revenue

The Revenue Department is responsible for the pricing policy, the sales, and the profitability analysis, and the yield considering the competition.

Airports

The airport department manages the 3rd party ground handling, assures the passengers and baggage handling, guarantees the ramp (Below Wing) availabilities, and in general coordinates the airports services needed by the fleets to reduce the idleness and respect the fleet schedule.

Cargo

The cargo department is responsible for the selling of cargo services, managing the warehouses, Supply chain, weight and Rate calculation considering the Competition.

Catering

The catering Department is responsible for the Duty-free, Assembly (3rd party), Chef, Warehousing (bonded / cold storage), the supply, the meal Design, and the network plan food.

MRO

The MRO department designs the fleet maintenance planning and realizes the Maintenance operations, manages contract rates & escalation related to the fleet maintenance activities and manages the Capacity Planning according the normal and seasonal demands for the short and medium term.

Flight operations

The flight operations department manages the Cabin Crew, the Pilots, works on flight performance (fuel) & on flight planning (Park), avoids overflying & navigation, manage the in-flight entertainment (IFE), is responsible for landing, parking, and layover expenses and manages the crew transportation in transit.

Marketing

The marketing department manages the brand, the advertising, the customer's loyalty, the Social Media, the product specifications and optimizes the customer experience.

4. Corruption risk through the aviation business supply chain

In the light of section three and section two, we will focus our analysis on the fleet management. In this section, we try to pinpoint which activity is the most susceptible to be a window for corruption.

Airline companies are capital-intensive and its primary assets are its fleet of planes generating the bulk of its revenues [21]. Then, when it is time to purchase planes, corruption is likely to take place. If there no purchase operations, conditions will be created to lease aircrafts. The case of Airbus illustrates very well the situation. This case has been revealed by ***Le Figaro*** a French daily morning newspaper founded in 1826 and published in Paris,

(https://www.theguardian.com/business/2020/jan/31/airbus-to-pay-record-3bn-in-fines-for-endemic-corruption).
Airbus agreed to pay a record £3bn about US3.8b in penalties after admitting it had paid huge bribes on an "endemic" basis to land contracts in 20 countries. The plane maker reached this settlement after an investigation that lasted four years and was conducted in the UK, France and the US. The company had paid, between 2011 and 2015, bribes in Malaysia, Sri Lanka, Indonesia, Taiwan, Ghana, China, Japan, Russia, Kuwait, Brazil, Turkey etc.

In the high court in London, Dame Victoria Sharp, the President of the Queen's Bench Division, approved the settlement struck with the UK's Serious Fraud Office (SFO). She said**:** "The seriousness of the criminality in this case hardly needs to be spelled out. As is acknowledged on all sides, it was grave." She added that the scale of the wrongdoing demonstrated that bribery was "endemic in two core business areas within Airbus".

Airbus, which admitted five counts of failing to prevent bribery, had used a network of secret agents to pay large-scale bribes to officials in foreign countries to land high-value contracts. This was run by a unit at its French headquarters, which its one-time chief executive Tom Enders reportedly called "bullshit castle".

The SFO started its investigation in 2016 after evidence emerged of "irregularities" involving Airbus's secret agents. The French and American investigations started later. The US settlement was approved in Washington by District Judge Thomas Hogan, who said: "It was a pervasive and pernicious bribery scheme in various divisions of Airbus SE that went on for a number of years."

This case defends the principles suggested in the second section. In the next section, these principles will be verified on our case of Tunisair.

5. The Case: Tunisair in Tunisia (Ticker: TAIR)

Tunisia is a small country in North Africa. It is bordered by Algeria to the west and southwest, Libya to the southeast, and the Mediterranean Sea to the north and east; covering 163,610 km^2 (63,170 sq mi). The cost of corruption in Tunisia is estimated at three billions per year [22]. Société Tunisienne de l'Air (Tunisair) is the most important airline company in Tunisia. This company will be our case to illustrate the principles developed in section 3. Our analysis is grounded on the experience of the author as an investigator in the Court of Auditors (Tunisia) http://www.courdescomptes.nat.tn/ and its report published in 2018 and the financial information available on the Tunisian stock exchange http://www.bvmt.com.tn and many journal articles and website analyses that will be cited throughout.

Tunisair was created in 1948 having a capital of DT106,199,000, 65% of which is detained by the Tunisian state, 25% by the private sector and 10% by retirement management companies. Tunisair transports passengers and frets. It employs around 7,800 people including 230 pilots and 700 hosts and hostesses. The fleet of the Company comprises of 28 aircrafts having an average of 18.4 years. The ratio of employees per aircraft is 278.5 compared to a standard ratio of 80 employees per aircraft. According to the ex-CEO of Tunisair Elyes Mnakbi [23], Tunisair does not require a number of employees exceeding 3,000, and as such currently employs 4,800 employees in excess to its needs.

Before the COVID-19 pandemic, Tunisair had been exploiting 83 regular routes serving European and African cities and Montreal. It also had some irregular routes determined by the tourist season and the pilgrimage to Mecca in Saudi Arabia. In 2017, the company transported more than 3,502,475 passengers. Tunisair is a stakeholder of the two other small companies operating in Tunisia: Tunisair Express and TunisAvia. From its founding in 1990 until 2000, Tunisair Express was known as Tuninter, initially limited to domestic routes (it is still the only airline to fly internally within Tunisia), Tuninter, as it was then known, obtained permission to begin international operations in 2000. The airline was renamed "SevenAir". SevenAir was owned by a relative of the wife of the former Tunisia President Zine El-Abidine Ben Ali who was forced to step down by protesters invading the main streets of the capital Tunis and chanting *karama* (dignity), for *hurriyyah* (freedom) *la Fasad* (no corruption) *degage* (go away). At the end of the day on January 14, the president left the country with his family for a long retirement journey in Saudi-Arabia leaving the country in chaos and the

government in shambles [24]. SevenAir was renamed TunisAir Express following the former president Ben Ali's departure from Tunisia. Now, Tunisair Express completes its mission of opening the regions inside Tunisia by ensuring regular connections to all the airports (Table1). It is also involved within Tunisair in the development of regular international lines and charters of proximity [25].

Table 1: Tunisair and Tunisair express

	Airline	
	Tunisair	TunisAir Express
IATA	**TU**	**UG**
ICAO	**TAR**	**TUX**
Callsign	TUNAIR	TUNEXPRESS
Commenced operations	**1948**	**1991**
Image		

Tunisair ranking according to the safety and the quality of service

Although, Tunisair is considered a safe company (6.5/7), its quality of service is ranked very low (2.5/10) according to **https://www.airlineratings.com**. Furthermore, based on more than 1500 reviews, Tunisair received 2/5 from Tripadvisor [26].

Tunisair is not ranked by many serious websites like https://skytraxratings.com and www.oag.com. The reason may be that Tunisair is rated the third worst airline by AirHelp, with a score of 5.15/10. A flight is considered on-time if it arrives to the arrival gate less than 15 minutes after the scheduled arrival time**.** This performance is measured according to the On Time Performance (OTP) rate. A high **airlines OTP** rate indicates that the airline is consistently on time across the board. According to www.oag.com the best OTP measured is 99.7% by T'way Air and the lowest is 69.5% for SilkAir.

For Tunisair, the investigation revealed that the percentage of the flights that arrived on time has been decreasing steadily over the years: from 52% in 2014 to 44% in 2017. It was the lowest rate for the company and far from the target of 70%. This weak performance is essentially due to a weak technical service on the ground. The number of flights that were delayed more than three hours during 2014 and 2017 has increased by 115% leading to an amount of compensation more than TD16m. For example, the average delay in 2019 on an average flight time of 2 hours and 21 minutes, Tunis- Paris, was 414 minutes [27]. The customers of Tunisair have reported a very poor customer service, with staff on the ground unable to provide clear and coherent help when flights are delayed as well as there being a persistent problem with baggage loss. Many customers reported a general sense that the service was just not up to scratch compared to other airline carriers [28]. In general, Tunisair is ccertified as a **2-Star Airline** for the quality of its airport and onboard product and staff service. Product ratings include seats, amenities, food & beverages, IFE, cleanliness etc., and service rating is for both cabin staff and ground staff [29].

Tunisair Financial Situation

Before the Covid-19 pandemic, although the level of profits remained high, supported by strong demand and a healthy economic backdrop, the airline industry generated an average net post-tax profit of $36.0 billion in 2015, 2016 and 2017 and an average of 26.8 billion in 2018 and 2019 [30, 31] (Figure 2). This was a five-consecutive year of robust financial outcomes in the broader historical context of the industry, albeit one that would simply be considered a normal performance in most industries. According to the IATA [30], the operating profit margin eased moderately between 2015 and 2019 as unit costs outpaced unit revenues. At an estimated 7.5% of revenues, the operating profit margin also remains around historical highs. Prior to 2015, industrywide operating profit margins of this order were last seen in the 1960s.

Tunisair missed the most profitable years 2015, 2016 and 2017 for the airlines industry. Tunisair has published, almost two years late in January 2020, its individual and consolidated financial statements as of December 31 for 2016 and 2017 [32]. These statements show a net loss of 226.4 million dinars (1 TND = 0.368789 USD, Mar 2, 2021) compared to a deficit of 185.3 million in 2017. An aggravation indicating a continued growth of expenses faster than products sales. In 2017, the company's revenues reached 1.32 billion dinars, compared to 1 billion a year earlier, an increase of 30%. In terms of scheduled passenger traffic, it increased by 11.3% (3,138,943 passengers in 2017 compared to 2,819,512 passengers transported in 2016). As for operating expenses, they went from 1.2 billion dinars to 1.5 billion between 2016 and 2017, an increase of 25.3%, including 452.6 million dinars of aeronautical fees, 317 million dinars of supplies consumed and 242.6 million in personnel costs. These ones have increased by 10.2% (+22 million dinars), are divided between ground staff (138.5 million dinars), technical flight personnel (64 million) and cabin crew (39.6 million). In this regard, the operating result shows a deficit of 125.2 million dinars, against a negative result of 134.2 million in 2016. In addition, the rent of planes has increased almost fivefold, going from 6.5 million dinars in 2016 to 32.8 million in 2017. This increase is due to the immobilization of 5 planes during 2017, to the increase in transport activity as well as the increase in the euro conversion rate. The 2017 financial year was also marked by a 75% increase in exchange losses totaling 105.7 million dinars, against 60.2 million a year earlier. This surge is mainly due to the increase in exchange rates: + 6.2% for the dollar and + 21.3% for the euro, which generated an 81% increase (30 million dinars) in the effect of updating of loans denominated in foreign currency to reach 66.3 million, and the increase of + 67% of the exchange effect relating to payments to reach 39.4 million dinars.

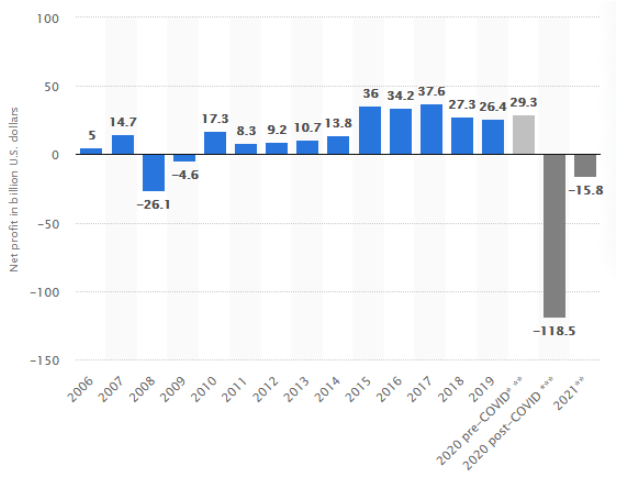

Figure 2 : Net profit of commercial airlines worldwide from 2006 to 2021 (in billion U.S. dollars

The present situation of Tunisair is catastrophic after it has been hurt by the Covid-19 pandemic and can no longer can pay its creditors. On February 19th, 2021, the company's bank accounts were frozen by a French Turkish company (TAV) because the company owes it millions of US dollars for airports service provided to Tunisair.

How did Tunisair arrive at this situation?

The lack of governance and the suspicion of corruption in the management of Tunisair operations in general and of its aircraft fleet are the most likely factors that lead to the company's critical situation. The aircraft fleet is the most important asset of Tunisair and according to the principle one, two and three (Section 2), it is most likely that the management of aircraft fleet is the theater of an organized corruption.

Tunisair's aircraft fleet

Tunisair's aircraft fleet consists in the May 2023 of 14 Airbus aircrafts see Table 2. This situation is much better compared to the situation in the beginning of 2021 where, Tunis air had 7 Boing 737 and 21 Airbus, and the average fleet age was 18.4 years. At that time, Tunisair had not have any plan to purchase any new aircrafts, this average age fleet is considered high compared to competitors like Royal air Morocco (11.4 years), Air Algeria (13.1 years) and Egyptair (7). In addition, of this aged fleet, the aircrafts maintenance service has not encountered the time planed. The result, some aircrafts are not available for a long time due to maintenance etc. Table 2 gives the downtime for Tunisair fleet. During 2015-2017, 2,546 days downtime have been registered. To continue offering its service Tunisair was required to lease 2,546 hours aircraft flight with an amount of DT 39.3 million during 2016 and 2017 (Table 3). This is a big amount for Tunisair, and it could subject to suspicion as corrupt situation could arise by creating a need of hours flight lease.

Table 2: Tunisair Fleet Matrix

Aircraft Type	In service	Parked	Total	Future	Historic	Avg age
Airbus A300					7	
Airbus A310					2	
Airbus A319	1	1	2		2	19.1 Years
Airbus A320	7	3	10	(1)	14	6.9 Years
Airbus A330	2		2			8.1 Years
Boeing 727					1	
Boeing 737					32	
Boeing 747					1	
DC 8					2	
DC 10					2	
MD 90					1	
	10	4	14	1	64	8.8 Y

(1) Aircraft in command

Source : www.planespotters.net/airline/Tunisair

www.planespotters.net/country/operators/Tunisia

Table 3: Current fleet

Aircraft	Type	Delivred	REM	Age(years)
TS-IMO	A319-100	Apr 2001		22.1
TS-IMQ	A319-100	Apr 2007	Parked	16.1
TS-IMR	A320-200	Jun 2010	Parked	12.9
TS-IMS	A320-200	May 2011	Parked	12.1
TS-IMT	A320-200	Jul 2012	Sticker	10.9
TS-IMU	A320-200	Feb 2013		10.3
TS-IMV	A320-200	Apr 2013	Parked	10.1
TS-IMW	A320-200	Nov 2014		8.6
TS-IMA	A320-200	Dec 2022		0.5
TS-IMX	A320-neo	Dec 2021		1.5
TS-IMY	A320-neo	Feb 2022		1.3
TS-IMZ	A320-neo	Oct 2022		0.6
TS-IFM	A320-200	Jun 2015		8.2
TS-IFN	A320-200	Aug 2015		8
TS-	A320-neo			

The infernal cycle of a bad Aircraft maintenance

The maintenance of Tunisair aircrafts is assured by a subsidiary company: Tunisair Technics (http://www.tunisairtechnics.com/). The contract signed with Tunisair Technics is not considering penalties clauses in case the maintenance plan is not respected. The result, respecting the scheduled maintenance plan is a challenge. Furthermore, Tunisair Technics refused in 2017 to accept a planned maintenance of three A320 aircraft without any penalties, invoking the reason of overbooking. A bad maintenance or an incomplete maintenance not completed on time lead to delay after delay. For example, in 2016, 106 days have been planned for the aircraft's maintenance. The reality was more than 300 days registered due to the incapacity to finance the engines maintenance made by Lufthansa in Germany. For this purpose, DT 91 M was needed in 2016 and the company could only assure only DT 20 M. Tunisair Technics is suffering from a lack of technicians and a reticence for working overtime hours.

Parts management

Tunisair is responsible for providing parts to the principal warehouse and the secondary ones according to aircrafts maintenance manuals.

Tunisair is using a lot of urgent orders to buy parts which are red flags indicating a perceived corruption according to principle 5 developed in section 2. The consequence is paying, on average, 88% more than the regular price. The increase of the urgent orders was by 49% in 2017 compared to a 17% in 2012. The assessment of 22 simple parts revealed that sometimes the price paid is

seven times more than a regular order when the order is urgent.

Even if the Tunisair procedure allows urgent orders only for aircrafts on ground (AOG) it was found that many parts, like the bulbs and the washer, bought urgently could be forecasted according to the aircraft maintenance manual. The amount of the urgent orders was DT 23m and it is determined that theses urgent orders are not justified most of the time. It is noticed that many parts ordered urgently were not used until they were expired. This situation raises, once again, perceived corruption.

Due to lack of parts in the warehouse, it is frequent to remove parts from aircrafts in the workshop for maintenance to be installed in other aircrafts. This practice extends the aircrafts downtime. The investigation revealed 22 times, during 2012-2017, where parts have been removed from aircrafts without any proof that they are installed in other aircrafts. Furthermore, during the period indicated, there are 658 cases of parts sent to be repaired or maintained and never come back to Tunisair Technics which is another case of perceived corruption. In addition, during this period, Tunisair bought parts urgently with an amount of DT 2.4 Million and these parts never used and are still in the warehouse. This could also be considered as perceived or suspected corruption as it indicates that there may be a corrupt network within the workings of Tunisair, this situation is evoked by principle 4. Figure 3: summarizes the major impacts of maintenance delays.

In such a situation, Tunisair is essentially forced to rent aircrafts in order to maintain the planned flights for an amount of DT 25.8m between 2014-2017. Furthermore, due the perturbation of Tunisair flights the permission of landing and takeoff called **Aeronautical Slot** and **airport SLOT** are frequently lost.

The **Aeronautical Slot** depends on EUROCONTROL in Brussels (which is in charge of managing the airspace), and it is the one that is granted so that there are no air collapses. It is also known as a take-off slot. To summarize, the Aeronautical Slot is the departure time that is dependent on Eurocontrol, which is based on congestion, traffic, weather conditions or some other incidents [33].

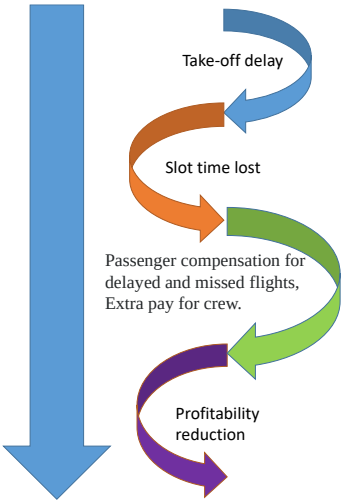

Figure 3: The infernal cycle of a bad Aircraft maintenance

The **airport slot** is an administrative authorization for the entry or exit of the aerodrome within a scheduled time slot stipulated by the airport. It is the time window in which an aircraft can take advantage of the infrastructure of the airport, check-in counters, parking lots, etc. The airport slot is always granted by the entity that manages the airport [33].

While there are no direct costs from missing a slot time, getting delayed will cause many indirect costs for an airline - passenger compensation for delayed and missed flights, extra pay for crew (on the plane and at the airports) and so on. So it may cost "thousands" to miss a slot time. Obviously, the exact amount will vary greatly from flight to flight [34].

Tunisair paid DT 16 million as customer compensations between 2014 and 2017. Despite this amount paid, Tunisair's compensation politics is not competitive compared to European airline companies. Based on the European Regulation No. 261/2004, all flights that are delayed 3 or over 3 hours are entitled to compensation based on flight distance:

- Short distance flight delays - up to 1500km - Passengers are due €250 compensation,
- Medium distance flight delays - between 1500km and 3500km - Passengers are due €400 compensation,
- Long distance flight delays - over 3500km - Passengers are due €600 compensation.

The cost of the ticket has no relevance to the total amount of compensation, and as such, a passenger will be able to claim on flights with low-cost airlines. It is also possible to claim on flights as far back as 6 years. However, for your claim to be eligible for compensation the flight must depart within the EU or, if it lands in the EU, the airline must have its headquarters in the EU [35].

Tunisair allows just one month in order to apply for compensation only for passengers who bought tickets from Tunisair only and it is not indicated how much the amount of the compensation. This situation does not give any competitive advantage to Tunisair.

Aircraft usage and Filling rate

The average international standards daily usage of aircrafts fleet is 10 hours for the A320 and B737 and 12 hours for A330. Tunisair performance was lower than the standards, which are respectively for the same aircrafts 8h33mn, 5h55mn and 7hours.

Tunisair had a filling rate of 69% between 2014-2016. This rate is very low compared to the international rates that could be more than 90%. For example, the percentage of passenger seats occupied on Air France-KLM flights was 86.8% in 2017 [36]. Tunisair did not make any study to assess the reasons behind this low filling rate of its aircrafts.

Pilots schedules

A pilot should assure 60 hours per month before he will be eligible to overtime payments. Many pilots have worked less than 60 hours and have been paid full salary. On the other hand, many pilots have been paid for overtime hours. Between 2016-2017, 28,961 hours have not been worked and an amount of DT5.7M has been paid. It is frequent that pilots refuse flights not in the plan. In 2017, 20% of the 6,037 flights proposed have been proposed by the pilots. The case when a pilot does not show up increased from 3,551 in 2014 to 4,063 cases in 2017. It should be noted that, in France, a pilot should assure 71 hours per month [37] compared to 60 hours for Tunisair pilots, which is 18.3% more. When a pilot knows that he will be absent, he can arrange with a colleague to replace him. The problem is when the replacement fulfills his duty, 60 h per month; the hours worked during the replacement will be paid overtime. During the period between 2016-2017, 288 replacements with 1,736 overtime hours have been paid.

How the pilot's flight hours are counted

Tunisair has a Netline Software used to plan the flights and to determine the flight hours for the aircrafts maintenance and when renting aircraft from other airlines. However, when it is time to determine the pilots air flights, they use the flight plan filled manually by the pilot. For Tunisair, the difference between Netline system and the hours compiled from the plan flights sheets filled by the pilots was 20,863. The extra amount paid to the pilots was DT5539m during 2015-2017.

6. Conclusion

Using the literature review, five principles related to corruption have been developed in this paper. These principles guided our analysis and investigation of Tunisair to detect the suspicious corruption situations in its supply chain activities. Tunisair is a Tunisian state airline company which now has 6 to 8 aircrafts in service from 28 aircrafts fleet. Perceived or suspected corruption situations have been detected starting from the fleet maintenance to the management of the fleet parts. The consequences of this situation are a deterioration of the quality of the service, low filing rate, flight schedules not being respected, many overtimes hours paid to the aircrafts crew, urgent orders to buy overpriced parts and to lease fleets.

This situation has led to an accumulation of almost a billion DT of deficit representing more than 15 times Tunisair market capitalisation (64.8 Million DT). Since 2017, Tunisair has not published its financial situations. From August 2020 to January 2021 Tunisair does not have a CEO. After the nomination, a young Lady (Olfa Hamdi) as CEO, she stayed only 6 weeks and again remained many months without CEO. Tunisair is suffering from a, perhaps, too-strong Labour Union and is having disagreements over how to rescue the loss-making national carrier. The Labor Union is also against Hamdi's plan to keep the Tunisian airline listed on the stock exchange and publish financial results for the past three years. The Union held frequent protests to demand that the government save their employer from closure, even if Tunisair has been subsidized by the state for decades. Tunisair suffers from a bloated payroll and, as this research assessed and was confirmed by Hamdi, Tunisair cannot afford to maintain the 21 aircrafts grounded. In one sentence, barring a miracle, the future of the company is in jeopardy.

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