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Economics of Turkish Aerospace Industry*

Türk Hava Savunma Sanayinin Ekonomisi

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Abstract

This paper provides a company survey of the Turkish Aerospace Industry (TAI) which is Turkey's largest defense and aerospace firm. The paper explains and describes the history of the company, its organization and performance. Various statistical indicators of TAI are used to measure competitiveness and efficiency, based on published data at the industry and firm level. The indicators include productivity, output, firm size, development time-scales, job creation, exports and profitability. The study concludes that TAI is developing an air defense company and the firm's productivity is increasing over time, but profitability rates are unstable. Although export level have been increasing their, share in total sales is insignificant and TAI usually meets the domestic demands where their most important customer is the Turkish government.

Keywords: *Aerospace industry, Aerospace markets, Defense, Turkey, TAI*

Öz

Bu makalede Türkiye'nin en büyük savunma ve havacılık firması olan Türk Havacılık ve Uzay Sanayii (TAI) kapsamlı olarak incelenmektedir. Çalışmada TAI'nin tarihçesi, kuruluşu ve performans göstergeleri incelenmektedir. Sektördeki ve firma düzeyindeki yayınlanan verilere dayanılarak, TAI›nin ve sektördeki diğer kuruluşların istatistiksel göstergeleri kullanılarak rekabet edebilirlik, verimlilik, çıktı düzeyi, firma büyüklüğü, iş yaratma kapasitesi, ihracat ve karlılığı ölçülmiştür. Bu çalışma ortaya koymaktadır ki, TAI gelişen hava savunma şirketidir ve firmanın üretkenliği zamanla artmakla beraber k karlılık oranları istikrarsızdır. Firmanın ihracat seviyesi artarken, toplam satışlardaki payı önemsizdir. TAI'nın en önemli pazarı payı iç pazardır ve çoğunlukla yerli talepleri karşılamaktadır.

Anahtar Kelimeler: *Hava Savunma Sanayi, Hava Savunma Pazarı, Savunma, Türkiye, TAI*

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Introduction

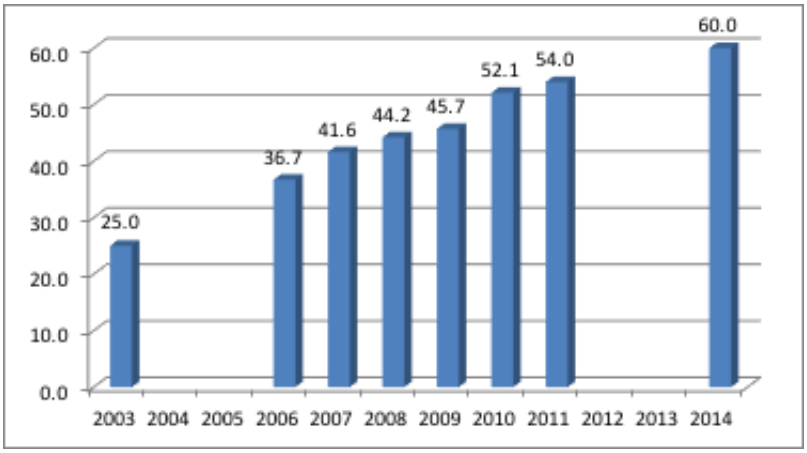
The aerospace industry uses high technology and also has one of the-growing market. According to Weidenbaum (1963) this industry sells to three major markets: defense, space, and commercial aircraft. In this study, a Turkish firm that makes production to those three markets will be analyzed.

Although there have been many opinions on the Turkish defense industry, its economic contribution has not been studied: Turkey did not show much presence in this sector until recent years. But for the last 15 years there have been many improvements in the defense industry. According to SASAD 2014 (Defense and Aerospace Industry Manufacturers Association) data, the industry's turnover was $5,101 million in 2014 with $1,895 million of export sales. The number of employees in this sector is more than 32000 personnel equivalent to one third of those working in this sector in the UK. In 2015, there were two Turkish firms in the World's top 100 industrial enterprises in defense sector: Aselsan (Turkish Armed Forces Foundation Company) and TAI (Turkish Aerospace Industry) (Defence News, 2015). The Turkish defense sector is a developing sector. Before that Turkey had been dependent on other countries, especially in the aviation and space industry: hence the analysis of Turkish Aerospace Industries (TAI) and its place in the Turkish economy. Company's sales, composed gross value added, developments in sales, exports, assets, turnover rate, equity, profit rates, employment and productivity will be addressed and changes between 1993 and 2013 will be analyzed. 'Turkey's 500 Big Industrial Organizations' publication which has been publishing by the Istanbul Chamber of Industry for every year will be in use for the statistical data. All data is given current price, converted to constant price to avoid inflation effect. Percentage increase in both prices are calculated and analyzed.

The aim of this study was to investigate the economic development of TAI and the Turkish aerospace industry and to assess its competitiveness. The next section presents general information on the Turkish defense industry, followed by a brief history of the Turkish aviation industry. In section four, TAI will be introduced and in section five TAI's performance and economic impacts will be analyzed.

The Turkish Defence Industry

According to World Military Expenditures and Arms Transfers (WMEAT 2015) data Turkey is holding the 18th place in the world defence market. Countries like Turkey, South Korea and Israel are the countries that increased a global competitiveness in the defense industry. In 2003, Turkish companies' share in national defense constituted only 25% of Turkey's overall defense spending. This ratio was rised from 45% in 2009 to 60% in 2014. Also in 2014 two Turkish companies entered the world's top 100 defense industry firms, namely ASELSAN and Turkish Aerospace Industries (TAI), (SIPRI, 2015). This emergence has greatly benefited Turkey's small to medium sized companies, who in many cases doubled or tripled their revenues and gained invaluable capabilities in defense technology and know-how (Trdefence, 2010).



Sources: Under secretariat for Defense Industries (SSM), 2011 *Year 2014 Milliyet Newspaper

Figure 1. Domestic Supply Turkish Armed Force Needs (%)

According to the Defense Industry Manufacturers Association (SASAD) survey, the sector of Turkish defense industry's total turnover was US$2.732 billion in 2010. Although there had been the world financial crisis in 2008, in 2009 the sector holds its total turnover position as equal to in 2008. As can be seen, under secretariat for Defense Industries (Savunma Sanayi Müsteşarlığı, SSM) especially did not postpone its programs, did not reduce its purchases and did not disrupt its payments (Figure 1). This sector was much affected by the crisis. Again according to SASAD data, exports of the Turkish Defense Industry in 2010 reached US$634 million whilst the investments in research and development (R&D) reached to US$666 million. The allocation of Turkish defense industry's turnover for 2009 was as follows: greatest turnover with 27% to electronics followed by 22% to aviation, 17% for land vehicles, 16% for naval, 12% for weapons and 6% for the alters (Yazgan, 2011).

Table 1. Turkish Defense and Aviation Industry 2011-2013

Years	Turnover (Million $)	Export (Million $)	R&D (Million $)	Employment (Person)
2011	4,381	1,090	672	24,160
2012	4,756	1,252	772	33,491
2013	5,076	1,391	927	32,368

Source: Under secretariat for Defense Industries, (SSM, 2015) (current prices)

As can be seen in Table 1, after 2010 the Turkish defense and aviation Industry almost doubled its turnover. This industry's turnover increased by 5.75% from 2012 to 2013 and reached US$5.076 billion in 2013. For the period from 2011 to 2013 exports increased by 10% and reached nearly US$1,400 billion. In 2011, the Turkish defense and aviation industry allocated US$ 672 million in R&D. In 2013, this figure reached US$927 million; equal to 18% of turnover in 2013.

Under secretariat for Defense Industries specified the 25 leading defense companies according to their last 5 years' manufacturing and sales figures, and financial statements. According to this, the first five are as follows: ASELSAN, TUSAŞ Aviation and Space Industry Inc. (TAI), Machine and Chemical Industry Association (MKEK), Automotive and Defense Industry Inc. (OTOKAR) and TUSAŞ Motor Industry Inc. (TEI) (Akşam, 2011).

For the future of the Turkish aviation industry, orders are increased from US$8,000 billion in 2013, to US$11,000 billion in 2014. This means that according to the 2014 turnover, sector orders are provide work for a period of approximately 5 years (SASAD, 2014). Turkish aviation sector resources allocated to R&D is mostly from the firm's equity. The government and the project have decreased steadily in the resources allocated to this area. The product and technology development is very important in order to future strengthen this sector and to increase the competitiveness.

History of Turkish Aerospace Industry

The first steps for aviation were taken in 1911. The first crucial decision was taken by Military Marshal Mahmut Şevket Pasha. In June 1, 1911 first establishment of Air Forces was laid within the Turkish Military Forces (Yalçın, 2011). During this period, only pilot training played an important role, not the designing and manufacturing technology. In 1912 during the Balkan War, there were only 2 pilots and 17 aircrafts that were bought from other countries. In 1914, during First World War, they battled offhanded. German military officers took the ruling of Turkish Air Forces. However during that period Germany, England and France had manufactured 165.619 aircrafts (Çakmak, 2003).

Aircraft and Motor Turkish Incorporated Company's (AMTIC) established in 1926 can be considered as the beginning of Turkish aircraft industry. After that, instead of directly purchasing aircraft, transport of technology was supplied. Until 1939 AMTIC's establishments (1928) in cities of Kayseri and Eskişehir produced 15 German Junkers A-20, 15 USA Hawk war aircrafts and 15 Gotha communication aircrafts out of 112 in total. After 1939, they stopped production and only performed maintenance of aircraft for the Air Forces (Evirgen, 2011).

In 1936, an aircraft factory was founded by Nuri Demirdağ in Istanbul and started production with the Nu.37 type. They produced 24 Nu.37 aircraft and many gliders before closing in 1943. The next step for the aviation industry was taken with the creation of an aircraft factory that was founded by the Turkish Aeronautical Association in 1941 in Ankara. It started manufacturing in 1944 and produced 80 Miles Magister training aircraft, ambulance aircraft, light transport aircraft for TAA, 60 Uğur training aircraft for two people and many gliders. In 1945 the first aircraft engine factory was founded in Ankara, and started production in 1948. Also in 1942, during the Second World War, aircraft maintenance ateliers were established in Malatya for the maintenance of aircraft that were bought from England (SASAD, 2011).

After World War II, within the Truman Doctrine and Marshall Plan, foreign assistance from USA and in 1952 with the beginning of NATO membership process, the surplus defense equipment of other allied countries was donated which resulted in blocked production of defense products inside the country. The capabilities that were acquainted in the 1920's and 1930's with great sacrifices were nearly lost with time (SSM, 2011).

During the 1964 Cyprus crisis, inconvenience dependence on other countries for defense needs became apparent. This provided a stimulus for independence policies to form a modern and self-sufficient defense industry in Turkey. Within this context, Air Forces (1970), Naval Forces (1972) and Land Forces (1974) Reinforcement Trusts were founded. In 1987, these three trusts were gathered under the roof of Turkish Armed Forces Reinforcement Trust (TAFRT). Until the establishment of the under secretariat for Defense Industries in 1985 the government generated the national defense industry. During this time, the Turkish Air Forces Reinforcement Trust was founded (1970) to improve national aviation industry. In 1974, while the Cyprus Peace Operation quickened progress; Turkey faced a US embargo and Turkish people made significant donations to Air, Marine and Land Forces Reinforcement Trusts. In short time these trusts set up foundations like ASELSAN (1975), İŞBİR (1979), ASPİLSAN (1981) and HAVELSAN (1982) which carried out investments for the national defense industry. Today, these defense industry foundations with trusts' capital still keep their important places in the sector (SASAD, 2011).

After 1980, Turkey started a structural transformation process and like many other sectors, the defense industry was re-organized. During this time major defense projects like the F-16 (1987), armour plated

Table 2. Aviation and Space Companies Operating Fields Headquarters

COMPANY NAME	OPERATING FIELDS	HEADQUARTERS
AEROMAC Aviation	Jet engines, aircraft test systems	İSTANBUL
ALP Aviation	Helicopter parts	ESKİŞEHİR
DELTA EKO Aviation	Software development, R&D projects	ANKARA
GLOBAL Technic	Air, sea and unmanned land vehicles	ANKARA
INTA SPACETÜRK	Viewing of Eurasia from space	ANKARA
TEI	Aircraft and helicopter parts	ESKİŞEHİR
TAI	Aircraft and other air vehicles, software and composite of materials	ANKARA

Source: The Union of Chambers and Commodity Exchanges of Turkey (2010)

war vehicle (1988), mobile sonar complexes (1990), F-16 Electronics, HF/SSB Transmitters and CASA Light Transport Aircrafts (1991) was started. Furthermore new companies by private sector like ROKETSAN (1988) were established. During this period, for the skills of Ministry of National Defense (MSB) and Undersecretariet for Defense Industries (SSM), Turkey's participation in Stinger air defense missile Europe joint production project provided major benefits (SASAD, 2011).

In Table 2, defense related companies that operate in the field of aviation and space, their operating areas and their headquarters are shows.

Turkish Aerospace Industry (TAI)

After the 1970's Turkey's aviation industry stepped in to a new period and speeded up with the foundation of TAI. TAI (Turkish Aerospace Industries) was established on May 15th, 1984 under the Turkish Commercial Code and Law on Encouragement of Foreign Capital. Today, it is a technology centre for aerospace design, development, manufacture, integration, modernization and after sale services areas for aircraft, helicopters, unmanned aerial vehicles (UAV) and satellite platforms. TAI is located in Akıncı-Ankara within 5 million square meters. 200,000 square meters is a closed area with high technology machinery and equipment which provide extensive manufacturing capabilities. In addition, in order to improve defense-aerospace skills and create common synergy among enterprises and universities, an important part of the engineering-based activities has been carried out in Techno Park which is located in the Middle East Technical University. TAI has world recognized quality systems, (NATO AQAP-2110, ISO-9001:2000 and AS EN 9100 standards). It has 3000 qualified and experienced employees, including 1200 engineers (Evirgen, 2011).

42% of the shares held by Lockheed Martin of Turkey and 7% of the shares held by General Electric International were purchased by the Turkish Aircraft Industries with "Share Purchase Agreement" signed on January 12th, 2005 with 98% of the company owned by Turkish Aircraft Industries Corporation (TAI). 1.9% of the company's share is owned by Turkish Military Forces Reinforcement Trust and 0.1% is owned by Turkish Aeronautical Association. TAI Chairman of the Board, Murat Bayar, indicated that final progresses have been a major step for the import substitution policy on defense industry (Radikal, 2005).

TAI was restructured in the year 2005. Along with this restructuring, TAI and TUSAS have merged under the roof of Turkish Aerospace Industries, Inc. (TAI) and have broadened its activities. Today, known as Turkish Aerospace Industries, Inc. (TAI) has become Turkey's center of technology in design, development, modernization, manufacturing, integration and life cycle support of integrated aerospace systems, from fixed and rotary wing air platforms to UAVs and satellites (TAI 2015). TAI is very effective in terms of design, manufacturing infrastructure and human resources and will serve as an "Aviation Center". It is also privileged supplier partner of Aermacchi, AgustaWestland, Airbus, Boeing, EADS CASA, Eurocopter, Lockheed Martin, Northrop Grumman, MDHI, Sikorsky and many other international companies (TAI, 2015).

After the nationalization of Turkish Aerospace Industries (TAI) a contract was signed with Alp Aviation for the production of 21 items for the Boeing 737 aircraft. This contract is integrates TAI with the local supplier industry and also it is Turkey's first effort transferring the manufacture of all parts of an aircraft to a civil supplier company (Halka ve Olaylara Tercüman, 2005).

From its foundation until the 1990's the Turkish Republic carried out its supplies from preset purchases. Within this concept light transport aircraft, primary trainer aircraft and helicopters for general purposes were bought. Between 1990 and 2000 joint production was on the agenda (e.g. Meltem sea discovery aircraft with Italian Alenia Aermacchi S.p.A and Cougar helicopter with EC Eurocopter). After 2000's original designs were started, like the unmanned aerial vehicles project and the Hürkuş Basic Training Aircraft (Evirgen, 2011). The first original projects were on conceptual design working for the development of primary-basic trainer aircraft and unmanned aerial vehicles (Hürriyet, 2005). Turkish Basic Trainer Aircraft "HÜRKUS" successfully realized its maiden flight on August 29, 2013 at TAI's premises in Ankara, Kazan. In December 2004, TAI received a contract from the Turkish Armed Forces to develop and produce the indigenous MALE UAV system as part of the

Turkish Unmanned Aerial Vehicle (TUAV) program. Under the TUAV project, TAI is responsible for developing three prototype UAVs and the associated ground systems. The preliminary design review (PDR) was completed in May 2008. Anka was unveiled at the Farnborough Air Show in July 2010. The first Anka UAV successfully completed its maiden flight in December 2010. The UAV demonstrated its automatic take-off and landing capabilities in November 2011. A technical issue caused the crashing of a prototype vehicle during final tests in September 2012. TAI completed the acceptance testing campaign of Anka in January 2013.

TAI, applying its experience and know-how, has taken significant steps towards development design, production, modernization, modification and systems integration of fixed and rotary wing aerial platforms, unmanned aerial vehicles and satellite areas. TAI has set up highly modern production facilities and started its activities for the final assembly of the Lockheed Martin F-16 fighters, CN-235 light transport/maritime patrol/surveillance aircraft, SF-260 trainers, Cougar AS-532 general purpose helicopters. Existing experience of TAI involve the following; production of F-16 fighters, the CN-235 light transport/maritime, patrol/surveillance aircraft, SF-260D aircraft training, Cougar AS-532 search and rescue (SAR), combat search and rescue (CSAR) and joint with French Aérospatiale SA 330 production of utility helicopters. Furthermore, it covers product development programs such as own design of unmanned aerial vehicles, target drones and agricultural aircraft. Accordingly, we can analyze TAI's projects in 3 groups; integrated helicopters, integrated aircraft, structural and satellite projection-production.

The integrated helicopter project includes designing helicopters for military and commercial use, production, mounting and also making modifications on current platforms. There have been three projects. Yarasa Program, Atak Program and ITU Light Commercial Helicopter Programme (TAI, 2010). As the main contractor of ATAK (Attack/Tactical Reconnaissance Helicopter Programme, T-129), TAI carries out its activities to ensure production and integrated logistics support of the helicopter according to user needs. This programme started on July 2nd, 2008. In the programme 50 firm and 41 optional T129 helicopters were to be produced depending on users' needs. The Yarasa Programme is a development and modernization project that is going to be applied to four Sikorsky S70 Black Hawk Helicopters in two stages. The Light Commercial Helicopter Research, Development and Practice Project that was signed between TAI and Istanbul Technical University have been implemented since 2002. The main aims of the project are to raise national knowledge level to "Knowledge Producing Level" in the areas of aviation technologies, especially on the analysis of air vehicles with rotating wings, their designs and production; and with the collaboration of the local industry to support local production based on advanced technologies; and also to produce a prototype helicopter (TAI, 2011). In February 21, 2014 between the SSM (Under secretariat for Defense Industries) and TAI signed for 109 units of the T70 general purpose helicopter in TAI's facilities. "BATS Program" which four of the S70 Black Hawk helicopter avionics modernization is the integration of the most comprehensive software has been carried out in turkey to date. This project has been completed and delivered to their owners (Staff of the Special Forces Command: TAI, 2015).

Integrated Aircraft Programme ANKA consists of Peace Eagle, ERCIYES, F-16, ONCEL IV, F-16 Serial Assembly Modernization Programme, Spotter-Short Sighted Tactics IHA System, KT_1 Training Aircraft, Meltem II, Meltem III, Pakistan Air Forces F-16 Modernization, POIII F-16 Modernization, T-38 Avionic Modernization, Turkish Primary & Basic Trainer Aircraft (Hürkuş), Turna/G Genuine Target Aircraft System and Jordan Air Forces (RJAF) F-16 programme. Erciyes programme consists of the modernization of 7 C-130E and 6 C-130B Hercules transport aircrafts that are in the air forces' inventory. TAI has developed Turkish Unmanned Aerial Vehicle (MALE) production programme, and is engaged in the design and development of Primary & Basic Trainer (HÜRKUŞ) Aircraft. Main target of this programme is to provide indigenous systems for the Turkish Armed Forces. Therefore, TAI continues to work programmes regarding the design and production of Turkish Primary & Basic Trainer Aircraft (HÜRKUŞ) and Turkish Indigenous Medium Altitude Long Endurance (MALE) Unmanned Aerial Vehicle (TIHA). TAI is also the prime contractor of the avionics modernization program of the C-130 transport aircraft and T-38 training aircraft that are in the inventory of the Turkish Air Force Command (TAF). Major moderni-

zation programs embrace Glass Cockpit modification of Turkish Black Hawk helicopters, electronic warfare retrofit and structural modifications of F-16s, Falcon Star and Mid Life which belongs to TAF. There are upgrade modifications of F-16's which is registered at Royal Jordanian Air Force, modification and modernization of Cougar AS-532, modification of CN-235 platforms for MPA/MSA missions for the Turkish Navy and Coast Guard, modification of ATR-72 platforms for the Turkish Navy as well as structural modification and systems integration activities required for the conversion of B737-700 aircraft into the Airborne Early Warning and Control Aircraft (MHS) (TAI, 2011). At 23 August 2011 between the Under secretariat for Defense Industries (SSM) and TAI a contract was signed towards meeting the Jet Trainer Aircraft and Air Force combat aircraft needs. Meltem III (AT-72) of the agreement signed between TAI and Italian Alenia Aermacchi SpA in July 2012 and 6 projects to ATR72-600 aircraft are converted to Maritime Patrol Aircraft. Aircraft to be converted were brought to the facility in April 2013 and has started the process (TAI, 2015).

Third group is the structural and satellite programme that has two groups. First, the group designs and produces parts/components for all kinds of aircraft and helicopters. Second group is satellite technologies. Its main goal is the development and production of satellite technologies mainly with respect to Turkey's needs and then with time to be an important name in the world. In this respect, a new Satellite Assembly and Integration Test Facility will be built. Therefore, TAI is the active participation of local subcontractors for Turkey's "Original Satellite Development Project". The framework of this Project, Göktürk 2 satellite was completed with the successful launch of in 2012 (TAI, 2015).

The other main activity of TAI covers modernization, modification and systems integration programs and after-sales services for both fixed and rotary wing military and commercial aircraft that are in the inventory of Turkey and other countries in the region. Furthermore, TAI is a partner of Airbus Military SL, which is participating in the activities of the A400M aircraft design and development with Airbus (France, Germany, Spain and the UK), EADS CASA (Spain) and FLABEL (Belgium), aerospace companies. With 25 years of experience, TAI is also involved in global-scale projects. In this context, TAI is a partner for the design and development of the Joint Strike Fighter (JSF/F-35) and A400M.

The shareholders of the Company are Turkish Armed Forces Foundation, under secretariat for Defense Industries and Turkish Aeronautical Association.

Comparison of Turkish Defence Companies with TAI

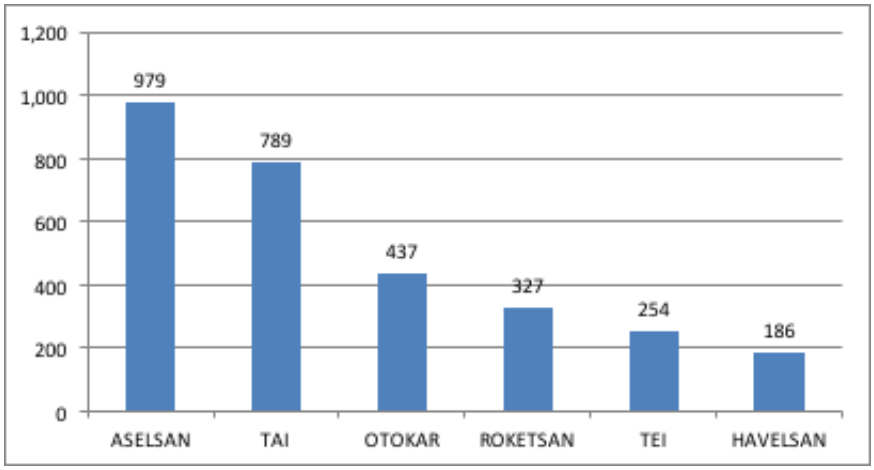
Defence companies that operate in Turkey are not limited by air defence, especially in recent years there have been significant increase in the number of defence firms that operates in Turkey. Comparison of Turkish defence companies with TAI is important in order to compare the efficiency of TAI. As can be seen from Table 3, sales, profits and efficiency rate of TAI is compared with some selected defence companies.

In Table 3 defence companies that are in 500 list and their operation field is given. According to net production sales the biggest company is ASELSAN which is specialised in electronic systems, Thermal Camera, binoculars, transmitters, night vision systems, radar and Software Company is 33rd in Turkey within 500 biggest firms and 70th in the largest defence firms in the World (SIPRI, 2015). On the other hand TAI is 88th in top 100 defence firms in the World (SIPRI, 2015). According to sales volume TAI is ranked as 50th. There are also firms like OTOKAR (Tactical Wheeled Armoured Vehicle, light Armoured Vehicle, Main Battle Tank), Roketsan (Rockets and Air Crafts Productions), TEI (Plane and Helicopters Engines), and Havelsan (Simulators, and Software) which are very important defence company in Turkey.

Table 3. The Sales Volume of Largest Defence Companies in Turkey (2014)

Ranking (2014)	Name of The Company	Field of Business	Net production Sales (2014)
33	ASELSAN	Electronic Combat, Thermal Camera, binoculars, transmitters, night vision systems, Radar, Software	$978,760,986 TL2,141,431,162
50	TAI (TUSAŞ)	fixed and rotary wing vehicles platforms, unmanned aerial vehicle, satellite design, modernization, system integration, production, Integrated logistic support	$789,015,768 TL1,726,287,599
88	OTOKAR	Tactical Wheeled Armoured Vehicle, light Armoured Vehicle, Main Battle Tank	$437,039,821 TL956,199,426
128	ROKETSAN	Rockets and Air Crafts Productions	$327,371,616 TL716,256,360
174	TEI	Plane and Helicopters Engines	$253,769,211 TL555,221,657
244	HAVELSAN	Simulators and Software	$185,897,168 TL406,724,416

Source: İSO (2014) (current US$ and constant Turkish Liras 2014=100)



Sources: SASAD, 2015 (current prices)

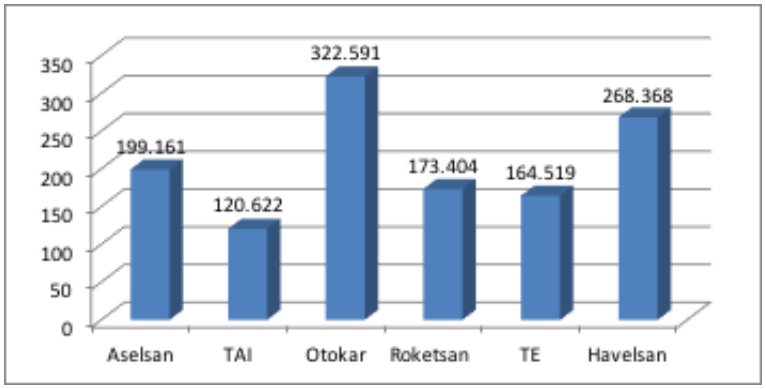
Figure 2. The Largest Defence Company in Turkey and Sales 2014 (million US$)

Sales, labour productivity and profitability of Defence companies that are in 500 list are given in Table 5. Examination of Table 4 and figure 2 indicates that the labour productivity and sales profitability of air defence company, TAI, is low compared to others. TAI low performance is followed by TEI which produce plane and helicopter engines. This sector requires high technology and one of the reasons for low labour productivity could be the absence of mass productions in these companies. Roketsan, which produces rockets and air vehicles are in the third place in low productivity. Other defence companies that are specialised in communication, software and electronic have higher productivity and profitability.

Table 4. Sales, Productivity and profitability, 2013

Name of the Company	Sales ($)	Labour Productivity ($)	Profitability (% of Sales)
Aselsan	964,537,817	199,161	4.3
TAI	534,478,045	120,622	3.6
Otokar	807,447,137	322,591	15.9
Roketsan	287,158,164	173,404	12.8
TEI	238,060,256	164,519	2.5
Havelsan	296,815,929	268,368	16.5

Source: İSO (2013) (current prices)



Source: İSO (2013)

Figure 3. Labour Productivity ($)

Value added per worker, exports and employment numbers are given in Table 5. Havelsan and Aselsan which are specialised mainly in software have higher value added. On the other hand, TAI is the fourth one according to value added per worker criteria. However, export and employment numbers of TAI is quite high. The low number of value added per person is general characteristics of the sector. Higher export number of TAI indicates the company doing rather well on international competition. For a more meaningful comparison, firms that are in the same operation field should be compared which is carried out in the later section.

Table 5. Value Added Per Worker, Exports and Employment

Firms	Value added per worker ($, current prices)	Export ($, current prices)	Employment (person)
Aselsan	98,560	200,372,000	4,843
TAI	68,396	440,677,000	4,431
Otokar	98,962	117,458,000	2,503
Roketsan	93,700	62,170,000	1,656
TEI	39,997	214,000,000	1,447
Havelsan	11,714	24,457,000	1,106

Source: İSO (2013)

Comparing Turkish air defence industry with developed countries showed that the air defence industry in Turkey is still developing. While, the sale amount per worker of air defence industry in Turkey is $156822, in developed countries that amount is $317580 on average (highest 364.994 $, and lowest 253. 787$). So

developed countries have twice the sales per worker compared to Turkey. We can compare the company sales in Table 6. While the larger companies' worker productivity (sales/employment) on average is €270.000.000, TAI is only €86.000, and profitability of TAI is also low.

A year earnings of workers that employed in air defence industry in Turkey is $ 34.750, it is $ 80.175 in USA, € 68.800 in France and € 64,920 in UK. Although Turkish air defence industry is developing, it has currently below average productivity of World companies. One of the reason for this could be relatively small scale of the company and TAI is not fully developed company.

Table 6. Defence Company Sales

Company	Sales (€ millions)	Labour Productivity (€)	Profitability (%)
Boeing*	61,920.6	355,049	7.4
EADS/Airbus*	56,480.0	402,264	3.8
United Technologies*	43,738.1	200,633	13,3
Lockheed Martin*	35,760.2	298,001	9.5
BAE Systems*	19,962,4	246,449	9.9
Finmeccanica	17,218.0	255,429	-2.4
Roll-Royce	14,544,5	339,824	11.3
Thales	14,158.1	214,542	5.6
Safran	13,615.0	217,638	10.3
Bombardier	12,708,8	N,A	4.1
Zodiac Aerospace	3,440.6	149,072	14.5
TAI (TUSAŞ)**	**361.8**	**86,718**	3.6

Source: *EC (2013), **İSO (2013) (current prices 2013)

Efficeny and Performance of TAI

This section analyses TAI's economic contribution and efficiency 'Turkey's 500 Big Industrial Organizations' annual publication by Istanbul Chamber of Industry is used for the statistical data. All financial values are converted to constant prices using GDP deflator to avoid inflation bias.

Gross Value Added

GDP contribution of industrial organizations, as measured by gross value added created and it shows the share of GDP generated income. When we look at the value added of TAI; gross value added increased from $ 65,466,181in 1993 to US$303,065,246 in 2013. It increased 446% in 20 years. There are very large fluctuations in these years. Because of major economic crisis in Turkey experienced in 1999 and 2001, TAI's contribution to the national income decreased 85%. Moreover, a change in the ownership structure of TAI in 2004 caused 50% decline on the gross value added. TAI has continued to increase its contribution to the national economy with new projects and more than $300 million has contributed to national income in 2013. Annual average increase rate of gross value added TAI created was changeable between -86.3% and 102.3%. Although value added TAI created in real terms was increased by 337.4% in 2000, fastest decrease took place with -58.1% in 2004.

Table 7. Gross Value Added

YEAR	Gross Value Added (Turkish Liras Current)	Gross Value Added (US$)	Annual change (%)
1993	719,209	65,466,181	…,
1994	1,359,561	45,769,789	-30.09
1995	2,780,383	60,875,257	33.00
2000	24,476,551	39,243,858	339.74
2001	51,694,419	42,185,344	7.50
2002	142,708,855	94,770,294	124.65
2003	115,880,596	77,612,416	-18.10
2004	54,535,851	38,342,312	-50.60
2005	103,504,408	77,196,584	101.34
2006	180,904,922	126,408,817	63.75
2007	197,350,842	151,632,213	19.95
2008	266,725,032	206,298,220	36.05
2009	350,392,998	226,489,598	9.79
2010	414,049,456	275,966,739	21.85
2011	641,559,587	384,167,417	39.21
2012	641,593,541	357,932,240	-6.83
2013	576,220,983	303,065,246	-15.33

Source: Calculated from ISO data: Economic and Social Indicators (1950-2014) Exchange Rates Republic of Turkey Ministry of Development (2015)

Sales Volume

During 1993-2013 while TAI sales increased from US$67499139 in 1993 to US$534443721 in 2013 (Table 8). During this period annual average increase rate of sales from production with was 18%, changing between -40.81% and 103.27%. During this period, fastest annual real increase in sales of production was 103.27% in 2001. In that year Turkey faced 2001 economic crisis, which had a devastating effect on Turkey However, proportion of equipment in the armed forces made outside Turkey is start to fall this year. In 1998, ownership structure changed, and sales decraesed dramatically after 1998.

Between 1993 and 2013, TAI sales of production increased average by 18.3% and the increase on gross value added was 33.5% which shows company's value added it created was more than its sales and the existence of producing input inside the company instead of assembly weighted operations. Because TAI started to produce self-developed models of unmanned aircraft and basic training aircraft in the last period. The increase in the value added created by TAI is more than its sales.

Table 8. Sales

YEAR	Sales Current US$	Annual change (%)	YEAR	Sales Current US$	Annual change (%)
1993	67,499,139		2004	66,150,296	0.28
1994	53,607,400	-20.58	2005	89,003,432	34.55
1995	68,170,064	27.17	2006	131,626,973	47.89
1996	68,935,411	1.12	2007	191,206,225	45.26
1997	108,715,642	57.71	2008	222,097,190	16.16
1998	81,444,271	-25.09	2009	341,220,854	53.64
1999	74,193,168	-8.90	2010	567,738,502	66.38
2000	47,287,393	-36.26	2011	776,895,431	36.84
2001	96,120,976	103.27	2012	465,129,828	-40.13
2002	111,450,408	15.95	2013	534,443,721	14.9
2003	65,964,432	-40.81			

Source: Calculated from ISO data,

Exports

While TAI's exports in 1993 were nearly 65.000 USD, in 2013 it rise to US$440.000 an increase of about 500%. With the economic crisis Turkey faced in 1999 Turkey's exports decreased to US$16.000 but it has been on constant increase since then. Annual average exports increased rate of 15.9%. Again during the same period, ratio of exports (US$) to net sales revenue (US$) is given in Table 9. According to these data TAI's share of exports in sales revenue is very poor

Table 9. Developments on Export

YEAR	Export (US$) (thousand)	Annual change (%)	Export/Sales Income (%)
1993	64,927	-	0.13
1994	57,018	-12.18	0.14
1995	67,832	18.97	0.13
1996	62,344	-8.09	0.12
1997	105,062	68.52	0.13
1998	76,684	-27.01	0.11
1999	59,718	-22.12	0.10
2000	16,677	-72.07	0.04
2001	35,751	114.37	0.04
2002	45,192	26.41	0.04
2003	40,742	-9.85	0.06
2004	49,750	22.11	0.07
2005	75,786	52.33	0.09
2006	116,952	54.32	0.09
2007	165,563	41.56	0.08
2008	182,438	10.19	0.09
2009	179,691	-1.51	0.05
2010	214,559	19.40	NA
2011	486,780	126.8	NA
2012	250,499	-48.5	NA
2013	440,677	75.9	NA

Source: Calculated from ISO data,

which is expected since TAI mostly manufactures for local markets and especially for the Turkish Defense Industry. While proportion of exports in sales revenues was 0.13% in 1993, it decreased to 0.05% in 2009.

Assets

TAI's total assets, and annual changes rate with current and constant prices between 1993 and 2013 are shown in Table 10. During this period total assets dramatically increased reaching to US$1,392,211,972 from US$144,855,584. Revaluation and inflation regulations that were applied due to high inflation until 2004 were effective in that increase. After this period, assets increase rate has been more consistent with the decrease in inflation and change in ownership structure.

Table 10. Assets (1999-2003)

YEAR	Total Assets US$	Annual change (%)	YEAR	Total Assets US$	Annual change (%)
1993	144,855,584		2004	402,016,465	67.62%
1994	130,107,723	-10.18%	2005	522,581,342	29.99%
1995	148,771,157	14.34%	2006	524,207,438	0.31%
1996	148,177,147	-0.40%	2007	726,189,055	38.53%
1997	219,651,744	48.24%	2008	1,003,990,444	38.25%
1998	247,574,494	12.71%	2009	1,165,282,043	16.07%
1999	390,821,993	57.86%	2010	1,462,049,993	25.47%
2000	238,063,144	-39.09%	2011	1,301,563,385	-10.98%
2001	228,687,430	-3.94%	2012	1,173,181,713	-9.86%
2002	318,257,113	39.17%	2013	1,392,211,972	18.67%
2003	239,841,852	-24.64%			

Source: Calculated from ISO data,

Profit and Profitability Ratios

TAI's profit/loss statements between 1993 and 2013 and annual increase rate with current TL and current dollar prices are shown in Table 11. In Table 13, profitability of owner's equity, sales profitability and economic profitability are indicated.

During that period, TAI's profitability showed very sharp increase. In 1993, profit increased by 510% from $16,926,055 to $103,345,683. Total profitability has a vast fluctuation and changing from -425% to 744% by years. Real total profitability reached its highest level in 2009 because of the 2008 global economic crisis and had its fastest decrease in 2004 because of the ownership's change.

Table 11. Period Profitability (1993-2013)

YEAR	Period Profit/Loss (TL) Before tax	Period Profit/Loss (USD$) Before tax	Profit Annual Change %
1993	185,949	16,926,055	
1994	1,293,889	43,558,933	157.35%
1995	1,919,738	42,031,815	-3.51%
2000	11,981,396	19,210,068	-81.15%
2004	-29,637,585	-20,837,183	-425.66%
2005	5,349,205	3989592	-119.15%
2008	1,860,307	1,438,853	-96.95%
2009	130,102,110	84,096,357	744.68%
2010	169,837,689	113,197,958	34.61%
2011	324,211,418	194,138,574	71.50%
2012	209,611,535	116,938,095	-39.77%
2013	196,492,180	103,345,683	-11.62%

Source: Calculated from ISO data,

Table 12. Profitability Ratios (1993-2013)

YEAR	Profitability of owners' equity (profit/owner's equity) %	Sales profitability (Profit / Sales) %	Economic profitability (value added/total assets) %
1993	26.08	24.87	45.19
1995	46.95	61.04	40.92
1997	62.28	50.00	36.58
1999	68.60	137.37	2.28
2001	34.80	34.71	18.45
2003	4.60	9.70	32.36
2005	1.68	4.48	14.77
2007	15.52	24.58	20.88
2009	25.88	22.88	19.44
2010	26.63	19.93	18.87
2011	35.79	24.98	29.51
2012	19.78	25.14	30.50
2013	18.90	19.33	21.76

Source: Calculated from ISO data,

As profitability indicator, profitability of owner's equity (financial profitability), sales profitability (turnover profitability) and economic profitability are calculated in Table 13. TAI's profitability of owner's equity had a decrease from 26% to 18.9% at the end of the period. Profitability of owner's equity had its lowest year in 2004 with -14.6%. Since TAI ownership structure was changed in 2004. Between 1999 and

2004 while the shares of TAI were owned by private shareholders (51% local, 49% foreign), since 2005 it is owned by local shareholders consisting of 45% public and 55% by private sector shareholders. During this period, profit/sales ratio as known sales profitability decreased from 24.8% to 19.3%. Sales profitability had its lowest year in 2004 with -31.5% as in profitability of owner's equity.

Economic profitability that is calculated with value added created to total assets (in other words to all sources) decreased from 45.1% to 19.4%. Decrease in economic profitability, creating lower value added considering used sources may be a sign of relatively increased importance of assembly featured products for this company. However, economic profitability rise to around 30% again after 2009; this shows the increase in value-added products.

Employment and Productivity

Between 1993 and 2013, change in TAI's number of wageworkers is shown in Table 13. The number of people employed is 5300 in 1993, after the economic crisis that Turkey experienced in 1994 was reduced by half. After 2006 it kept increasing constantly and reached 3,000 employees. During this period, average annual increase in employment rate was -1.4%. After this date, the ratio for workers increased steadily and reached 4,400 in 2013. TAI's creating employment capacity is lower than its capacity of creating national income due to capital intensive structure of the industry.

Table 13. Employment (1993-2013)

YEAR	Number of workers	Change in the number of workers	Change in the Ratio of workers (%)
1993	5,367	-	-
1994	2,313	-3,054	-56.90
1995	2,266	-47	-2.03
2000	1,923	-8	-0.41
2005	1,968	231	13.30
2007	2,567	278	12.15
2008	2,995	428	16.67
2009	3,046	51	1.70
2010	3,360	314	10.30
2011	3,947	587	17.47
2012	4,172	225	5.70
2013	4,431	259	6.20

Source: Calculated from ISO data

Per Capita Gross Value Added, Per Capita Sales and Per Capita Profits are given in Table 14. Gross value added per worker was $ 12,197 in 1993 and it rised %460 and reached $68.389. After restructuring of TAI in 2005, the company began to develop their own projects to meet the needs of the Turkish military. Since then, in value added per labour has increased rapidly. While sales of production per worker increased by 859% reaching to $120.615 from $12.577 between 1993 and 2013. Profit per worker has also increased from $3,154 to$23.323.

Table 14. Gross Value Added, Sales and Profits

YEAR	Per Çapta Gross Value Added (US$)	Per Capita Sales (US$)	Per Capita Profit (US$)
1993	12,198	12,577	3,154
1994	19,788	23,177	18,832
1995	26,865	30,084	18,549
2000	20,408	24,590	9,990
2004	22,074	38,083	-11,996
2005	39,226	45,225	2,027
2010	82,133	168,970	33,690
2011	97,331	196,832	49,186
2012	85,794	111,488	28,029
2013	68,397	120,615	23,323

Conclusions

In this study, TAI, the most important foundation of Turkish Aerospace Industry, was analysed. TAI's economic performance, value added it created, sales, export, profitability and efficiency indicators between 1993 and 2013 were evaluated. All data showed tremendous fluctuations during those years. The biggest reason of those fluctuations was the high rate inflation that Turkish economy had experienced between 1993 and 2004. The second reason was the changes in the ownership structure of the company.

During the study years, TAI's gross value added created and sales of production increased in real terms. Moreover, average increase rate of value added is higher than average increase rate of sales that is considered as an indicator of TAI's production of input internally instead of assembly weighted business. Decrease in economic profitability and creating low value added considering used sources might be an indicator of relative increased importance of assembly featured products within this company. Although exports have been increasing in years, share in total sales is insignificant on the grounds that TAI usually meets the domestic demands where their most important customer is the government. Job creating capacity rate is found relatively low. This is an expected result for capital-intensive sector of aerospace industry. TAI is the second largest defence company after ASELSAN. Although TAI's workforce and sales efficiency are quite low compared to other defense companies, exports and employment creation are much better than other defense companies.

Comparing Turkish air defence industry with developed countries showed that the air defence industry in Turkey is still developing. Although Turkish air defence industry is developing, it has currently below average productivity of World companies. One of the reasons for this could be relatively small scale of the company and TAI is not fully developed company.

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Appendix: Main productions of Aerospace Industry in Turkey

CN-235 Light Transport/ Maritime Patrol/ Surveillance Aircraft (TAI)

Component and Parts Manufacturing (TAI)

Cougar AS-532 Helicopter (TAI)

F-16 Fighting Falcon Modernisation (TAI)

Aircraft/ Helicopter and Gas Turbine Parts (TEI)

Aircraft/ Helicopter Structural and Aircraft Engine Components (ALP- Aviation)

F-4 E IFF MODE-4 Receiver/ Transmitter (GATE Electronic)

Open Skies Aircraft Integration Services (HAVELSAN)

SF-260D Primary Trainer Aircraft (TAI)

Tests of Aircraft Engines and Parts (GE Marmara Technology Centre)

X-BAND Satellite Communication System (ASELSAN)

Source: http://www.izmirdeyatirim.com/sektorler/yuksek-teknolojiler-elektronik-sektoru.html (12December 2011)