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Innovation Management in Defence and Aviation Industry in Turkiye - A case study on Ostim Defence and Aviation Cluster

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Abstract

The Defence and Aviation Industry (DAI) is one of the critical sectors where the world's most significant technological advances are experienced. According to a report prepared by Deloitte entitled 2020 global aerospace and defence industry outlook, military expenditures are rising as security threats continue to intensify worldwide. In addition, technological developments and innovation continually shape the DAI. Today, innovation management is again at the forefront of the global rivalry reshaping the international security environment. In this context, Turkiye's recent defence industry investments have become a significant issue that should be analysed regarding innovation management. This article aims to provide factual information regarding the implementation of an innovation management system in the companies affiliated with the OSTIM Defence and Aviation Cluster and to investigate the organisational capabilities of these companies' compliance with ISO 56002 standards on innovation management.

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1. Introduction

DAI is a high-tech industry that manufactures civil, military, aerospace, and defence equipment. It has become an essential component of global infrastructure, economic growth, international trade, and globalisation. DAI also has a crucial role in the state's national security. (Antonio, et al., 2019) According to a 2020 global aerospace and defence industry outlook report, demand for military equipment is on the rise as governments across the globe focus on military modernisation, given increasing global security concerns (Deloitte, 2020).

Turkiye has been making significant investments in the DAI sector recently. Hence, Turkiye has become a country making an impression in the world with its successful projects in the defence industry. The progression in the DAI sector under the leadership of large-scale public companies has led to the emergence of an ecosystem. One of the most critical elements of this ecosystem is undoubtedly the clusters created by small and medium-sized (SME) companies. Therefore, the innovation activities of SME companies in the defence and aerospace ecosystem are vitally crucial in terms of Turkiye's international economic and competitive capacity and global and regional political objectives. Suppose the right strategies and policies are set and followed. In that case, SME companies have the potential to lead the trail-blazing initiatives, which might be entirely affected by all existing balances on a global scale. In this study, the activities of SME companies conducting projects in the defence and aviation sectors in the OSTIM industrial zone will be analysed and evaluated in the context of innovation management.

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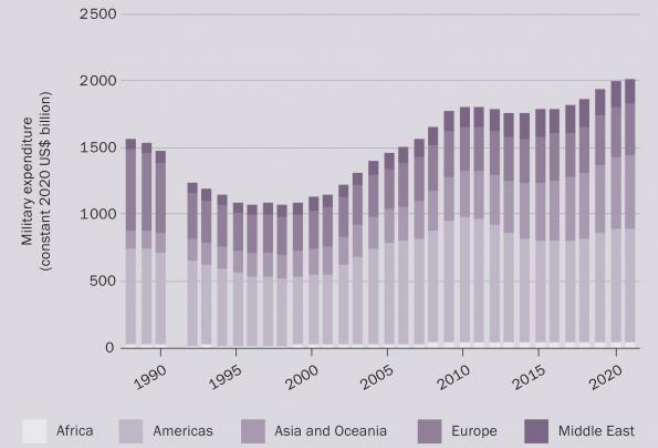
Before analysing the innovation implementations of SME companies conducted a project on DAI in Ostim, it would be empirically and methodologically beneficial to take a glance at the current worldwide situation of DAI to grasp the size and importance of the sector on a global scale.

2. DAI's Worldwide Status

According to a report published by Stockholm International Peace Research Institute (SIPRI), world military expenditure has surpassed $2 trillion for the first time. The chart in Figure 1 illustrates the world military expenditure from 1988 to 2021 by region (SIPRI).

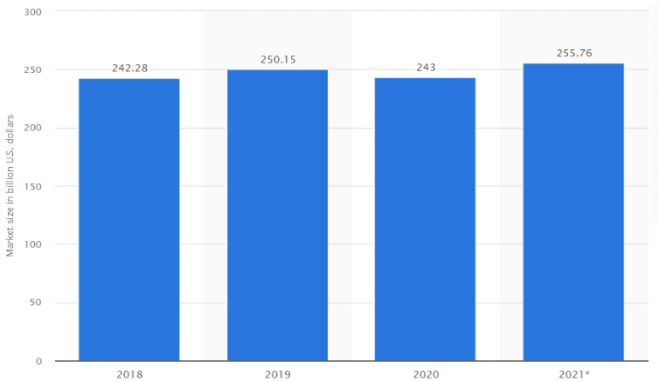
Figure 1. World military expenditure from 1988 to 2021 by region



Source: https://sipri.org/media/press-release/2022/world-military-expenditure-passes-2-trillion-first-time

The chart in Figure 2 illustrates the size of the military aircraft and aerospace manufacturing market from 2018 to 2021 (Statista).

Figure 2. The size of the military aircraft and aerospace manufacturing market worldwide from 2018 to 2021



Source: https://www.statista.com/statistics/1185271/global-military-aircraft-and-aerospace-manufacturing-market-size/

After the Russian Military intervention in Ukraine, countries worldwide are developing and operationalising DAI for military purposes. In light of current global developments, it is predicted that competition in the field of the defence industry will be at its highest level worldwide after the second world war period. Hence, the matter of innovation and its management, which is currently assumed as one of the driving forces behind global competition and which is likely to constitute the most vital dimension of international competition shortly in the field of DIA, will be discussed in the next subtitle.

3. Innovation Management

Innovation is defined as creating better, more effective, or more efficient processes and services, as well as developing the ideas and culture that will foster creativity (Crumpton, 2012, p.98). DAI is a sector that must properly implement innovation management to catch changes and new trends, as well as for optimisations such as cost reduction, quality improvement, and productivity growth. In this regard, innovation can make a difference on both the demand and cost sides of any business by helping them maintain its competitive edge (Nicolau & Maria, 2012, p.44). That is why innovation has been at the centre of competitiveness (Denton,1999, p.1).

International competition has pressured companies to continuously innovate to produce differentiated products and services (Schilling, 2020, p.1). For this reason, innovation has become a survival imperative for countries due to competition in international markets. Therefore, almost all governments offer companies special incentives and support opportunities to increase their country's share in international trade. Hence, innovation management has become an essential matter in the international arena, which has a highly dynamic structure.

Before delving into the specifics, it is worth noting the focus of the studies on innovation management. Igartua and Albors attempted to define the scope of innovation management for SMEs and created the table below, which depicts the various aspects of innovation management on which different authors have focused (Igartua & Albors, 2011, p.109).

Table 1. Authors' focus areas on innovation management (Igartua & Albors, 2011, p.109)

Innovation Management Areas	Authors																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOT
Strategy	*	*	*	*	*	*	*	*		*	*	*	*				12
Portfolios	*						*						*	*	*		5
Projects	*							*					*	*			4
Leadership and culture	*	*	*		*	*	*	*							*	*	9
People	*		*	*	*	*		*					*				7
External Relations	*	*	*			*					*	*					5
Organisation	*	*		*	*	*	*	*			*	*			*		10
Processes	*	*	*	*	*	*		*	*	*		*	*		*	*	13
Performance measures	*		*														2
Market							*		*		*	*				*	5
Resources										*						*	2
Knowledge												*					1
Technology											*			*		*	3

(1) (B+I Strategy, 2007)	(2) (Bessant and Tidd, 2007)	(3) (European Foundation for Quality Management, 2005)	(4) (Goffin and Mitchell, 2005)
(5) (Storey and Salaman, 2005)	(6) (Tidd et al., 2005)	(7) (Yang et al., 2003)	(8) (Dankbaar, 2003)
(9) (Durand, 2003)	(10) (Hidalgo Nuchera et al., 2002)	(11) (Trott, 2005)	(12) (Dodgson, 2000)
(13) (Goffin and Pfeiffer, 1999)	(14) (Escorsa Castell et al., 1997)	(15) (Brown, 1997)	(16) (Chiesa et al., 1996)

While innovation may have been defined differently by different writers over the years, there is a strong consensus on what innovation is fundamentally about, namely the creation of something useful that has a value derived from its novelty (Williams, 2020, p.3).

Nowadays, innovation is defined as an extended process of picking up on ideas for change and turning them into effective reality (Tidd & Bessant, 2021, pp. 44-45). Additionally, the matter on which every author agree is that innovation is a complex process that carries risks and needs careful and systematic management. Innovation management includes the phases of managing an organisation's innovation procedure, from the first stage of an idea to the final stage of successful implementation. It covers the decisions, activities and practices of designing and implementing an innovation strategy. In this regard, a vital guidance document entitled ISO 56002:2019 Innovation Management System needs to be examined.

3.1 ISO 56002:2019 Innovation Management System (IMS)

The 56002:2019 International Standard – Innovation Management System is a guidance document. It has great importance due to well-organised operational Innovation Management Systems that will drive long-term growth, economic viability, increased employee morale, improved return on investment, lower attrition rates, and increased market share. Innovative companies focus on design quality and reduce the number of difficulties encountered during the production phase, allowing them to focus less on problems and more on the potential for development. (ISO Standards, 56002:2019)

The 56002:2019 International Standard – IMS consists of an introduction and ten clauses. In the latest version of ISO Standards 56000:2020, innovation is defined as a "new or changed entity, realising or redistributing value." (ISO Standards, 56000:2020)

A company's management creates an environment conducive to work innovation, which grows as they build the standards and systems required to either kickstart or nourish an individual's creativity so that it blooms across the company's branches and individuals. Management must incorporate creativity into daily activities to create a positive example for their personnel. Every manager should set a goal to make creative/innovative improvements in their daily operations. An IMS helps a company decide its innovation vision, strategy, policy, and objectives, as well as the support and processes required to accomplish the desired results. ISO 56002:2019 explains why doing an innovation evaluation is desirable, what to anticipate from a good one, how to conduct one, and how to act on the findings. (ISO Standards, 56002:2019)

3.1.1 The Potential Benefits of Improving IMS

- Improving IMS has several advantages, including:
- Becoming a market leader in product categories.
- Increase the stock's worth.
- Increase employee value-added.
- Increase asset return on investment
- Reduce the number of unknowns/ uncertainties.
- Boost staff morale.
- Expand market share.
- Enhance client satisfaction.
- The ability to foresee the demands of customers.
- Keep workload variations to a minimum.
- Build a resilient company by being better equipped to handle change with less opposition.
- Increase the investors'/shareholders' dividends.
- Efficiencies, effectiveness, and adaptability will all improve.
- Improve sustainability and resilience.
- Increase critical personnel bonuses.

- Increase stakeholder satisfaction.
- Engage and empower people in the organisation.
- Increase ability to attract partners, collaborators, and funding.
- Attract challenging and resourceful people to join the organisation.
- Improve the organisation's reputation and valuation.
- Reduce legal expenses.

The potential benefits of IMS mentioned above are the essential milestones which substantially constitute the IMS Principles.

3.1.2 IMS Principles

A management principle is a broad and basic guideline governing all management aspects. A management principle is a promise made by each manager to regulate their interactions and conducts. Principles are the pledges that the organisation makes to its stakeholders that these are the rules that it will follow. Many companies choose to have a set of beliefs or values rather than principles because they believe principles are too restrictive with criteria. Therefore, ISO 56002: 2019 International Standard – IMS has vital importance as it standardises several principles that may differ from company to company.

ISO 56002:2019 establishes eight IMS principles such as 1. realisation of added-value, 2. future-focused leaders, 3. strategic direction, 4. culture, 5. exploiting insights, 6. managing uncertainty, 7. adaptability, 8. system's approach. (Benraouane & Harrington, 2021, p. xxix)

4. IMS in OSTIM Defence and Aviation Cluster (OSSA)

OSSA, one of Turkiye's leading defence and aviation clusters, was founded on July 1, 2008, under the direction of OSTİM. OSSA now has over 260 member companies with almost 10,000 workers. R&D, design, software, composite manufacturing, electronics, electromechanics, harness, machining, sheet metal forming, surface development, test/calibration, coating/painting, optical systems, hydraulic systems, machinery/equipment manufacturing, unmanned systems, and many other final products and subsystems are among the capabilities of these companies. OSSA creates significant synergies to encourage R&D and innovation activities. OSSA offers services to member companies in finding new markets and promoting international cooperation to provide a competitive advantage by adapting technology (digitalisation). It improves institutionalism, quality systems, and specialisation. OSSA's main focus is to create a roadmap for domestic and international cooperation and collaboration by increasing the competitive level of member companies. OSSA continues to work on SME-specific strategies by organising events to gain competitive advantages in Turkiye and abroad. It organises delegation visits, domestic and international promotion, representation, marketing activities, press and public relations, technology transfer, and joint projects as part of the university-industry collaboration (OSSA). This research article has emerged due to the cooperation between OSSA and Ostim Technical University.

4.1 Innovation Management in OSSA

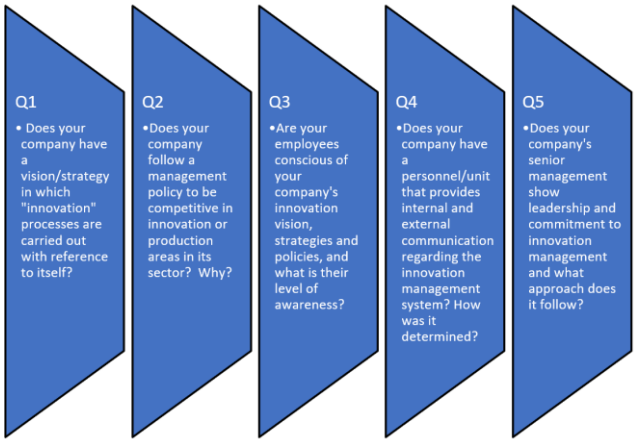
Within the scope of this research, interviews were conducted with the managers of four companies that are OSSA members. In these interviews, a series of questions were asked to the companies regarding awareness and implementation of ISO 56002:2019 International Standard – Innovation Management System.

In this context, the first question asked to companies is whether they have information about the ISO 56002 standard or not. All the companies interviewed stated they needed relevant information about ISO 56002 Standard, as seen in Figure 3.

Figure 3. Awareness of the Companies regarding ISO:56002 IMS

Because the ISO 56002 standard is a relatively new standard published just before the pandemic, the following questions were asked to determine whether the companies' innovation activities are by the ISO 56002 standard.

The question set and the empirical findings obtained within the scope of the research is given in the tables below. The question set has been carefully crafted to reflect the critical issues in ISO 56002 standards. The figure below depicts the first question set prepared to assess awareness of Innovation Management.



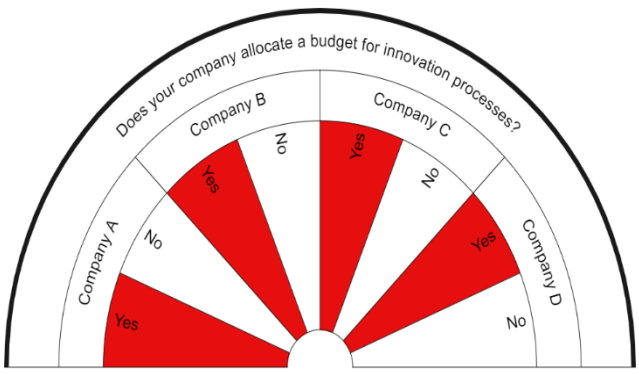
The companies' responses to the first set of questions are summarised in the table below.

Question Set: 1	**Answers Given**	
Q.1 Does your company have a vision/strategy in which "innovation" processes are carried out about itself?	Company A	We do not have any.
	Company B	Our strategy is determined by the public defence industry companies that we work with as sub-industry.
	Company C	Yes, it has. First of all, we started to work as an R&D company. We have an R&D department. We follow the AS-9100 standard, which is vital for companies making R&D for the defence industry. We carry out all processes related to both design and production according to this Standard.
	Company D	We do not have any.
Q2. Does your company follow a management policy to be competitive in innovation or production areas in its sector? Why?	Company A	We follow a competitive policy; we want to sell our products to the world. Our goal is to be competitive across the globe. We are looking for ways to achieve this.
	Company B	We have to be competitive as there are many competitors in the industry.
	Company C	We do not have a written management policy. We have the strategy. It is done every year, but it is done every three years. It is renewed every year for three years. What are we going to do in the next three years? So right now, we have a 2023-2025 plan. This document will be revised next year; it will be 2024-2026.
	Company D	We do it because we have to do it. We work primarily for public defence industry companies. We allocate space for new needs and expansions in our technical work as much as possible. We are allocating resources to other projects that we want to do with our resources.
Q3. Are your employees conscious of your company's innovation vision, strategies and policies, and what is their level of awareness?	Company A	We are trying to design and manufacture something new. We are walking the road with friends who want to do this.
	Company B	The awareness level of our staff is relatively high. We have a team that follows the developments in the world. Their English level is satisfactory. This way, we can follow the publications (literature) in foreign languages.
	Company C	In particular, the awareness level of the R&D team is very high. There are even some rewards related to them. If you get a patent, this is what happens if the TÜBİTAK project is approved; if you do it, that is, if you get support, R&D nor KOSGEB, TÜBİTAK, such as premiums. This is what we call an award regulation. If innovation is not the case, we do not limit innovation only to R&D. We have such a suggestion and reward mechanism that will provide an innovative motivation for better processes in production and even among blue-collar workers.
	Company D	There is no specific process defined for Innovation or R&D in our company. We have processes related to the overall goals of the company. That includes Innovation and R&D. For this reason, we do not make any innovation-specific notifications to the personnel.
Q4. Does your company have a personnel/unit that provides internal and external communication regarding the innovation management system? How was it determined?	Company A	We do not have.
	Company B	We opened an office in Ostim Teknopark for R&D activities. That is an environment where incentives can be obtained for R&D projects. We are assigning staff with more academic aspects.
	Company C	We do not have Innovation Department; we have an R&D department. Our company, the branches in which we do business, and our sectors are already evident in those strategic plans. All of us, including myself, follow the processes related to incentives. We follow TEYDEB and KOSGEB programs. These are precious things. Because if you do not have these supports, you are spending it out of your pocket. R&D and innovation are

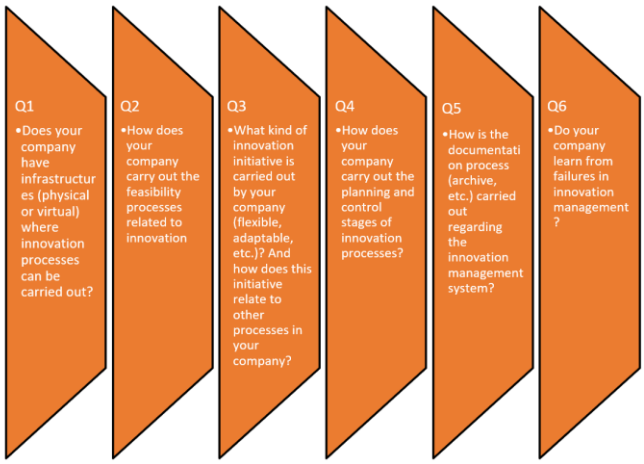
		businesses that have little chance of turning into money. You found something you did market research, but that is relatively low stuff.
	Company D	No. There is no particular person or department. We have activities related to TUBITAK and ASGEB's incentives. But we do not have a special department for that.
Q5. Do your company's senior management show leadership and commitment to innovation management, and what approach does it follow?	Company A	Unfortunately, we do not have such processes. As the company management, we are inspired by the developments in the world.
	Company B	Our company management is very enthusiastic about investing in R&D projects; we have plans to take advantage of the necessary incentives. Our senior management has plans to transform the company into an R&D company.
	Company C	I am the owner of the company. I started as an R&D personnel. Now I want everyone to do R&D. This is not very possible. There are better approaches than this. Our managers are looking for a trained man for R&D. That is the problem. Let me hire an engineer to solve this problem. This is a complicated thing.
	Company D	We work on being innovative or competitive; we evaluate possibilities. This happens mainly at the senior management level.

In the second set of questions, there are seven questions assessing companies' capacity for innovation practices. In this context, the first question asked was about budget allotment to determine whether companies value innovation.

Figure 4. Budget allocation for innovation processes



The allocation of budgets for innovation processes of all companies, as seen in the table above, is an essential indicator of the importance given to innovation. The figure below depicts additional six questions from the second set.



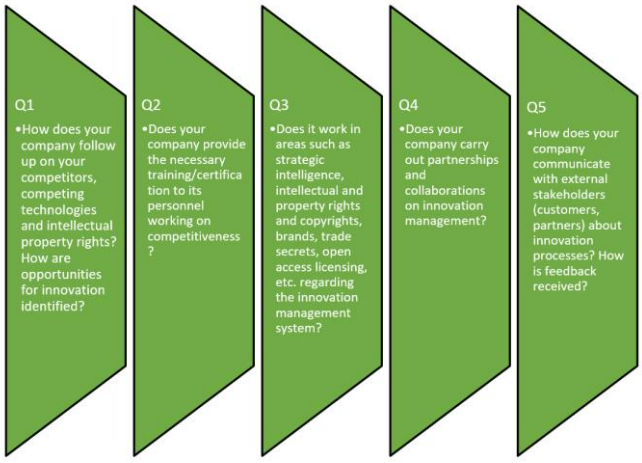
The table below summarises the companies' responses to the second question set.

Question Set:2	**Answers Given**	
Q1. Does your company have infrastructures (physical or virtual) where innovation processes can be carried out?	Company A	We are trying to determine innovation-related documents or roadmaps ourselves. We have yet to be very successful as a new company in its infancy. However, we can set target points for which products we make ourselves and where we can reach them. We define a roadmap. Nevertheless, we did not turn them into written documentation.
	Company B	We need to be able to conduct healthy experiments in a laboratory environment. Of course, this happens with infrastructure investments, and we are currently trying to invest in these areas.
	Company C	Well, once there are the tools required for design. So mechanical engineers need some equipment. In a soft or hardware sense, electronic engineers need some equipment. Of course, we call it both design tools and facilities. In other words, what is meant by this facility is an excellent place where the staff will work for once. We have them.
	Company D	Yes, we have. Firstly, we provide a suitable working environment with our company building. Secondly, we have the necessary

		equipment, the necessary tools, and devices to be used in the development process, and we buy new ones if necessary. We use outsources or the method of renting devices.
Q2. How does your company carry out the feasibility processes related to innovation?	Company A	Very detailed feasibility works are carried out outside of SME scale companies. We have done the feasibility works on simple excel spreadsheets. Now we want to employ new personnel to work on R&D and developing new products. This personnel will only make feasibilities on what is being done in the world, where the world is going, where we are in this, or how we can be involved in the processes.
	Company B	The feasibility works of our company are generally carried out in the form of meetings held to correctly understand the need for the products we have developed for public defence industry companies.
	Company C	There is an R&D that will be offered outside. That is to the customer, that is, the customer wants R&D from our company. In such a case, the technical requirements are precise. This kind of feasibility process is easy. There are also R&D projects that we carry out ourselves. In this context, we search for technological capabilities, including literature research. We experiment with it through technology. Whether it can be done or not, we make the feasibility of it.
	Company D	The feasibility activities that we do the most are the works that the current main contractors want to have done. For this, we are doing a few days of research work. Here, we determine the amount and cost of labour and materials used. We evaluate the opportunity and risk of doing this project and compare it with other possible projects. Then we try to determine a price. In every new project, we increase efficiency or make it scalable.
Q3. What kind of innovation initiative is carried out by your company (flexible, adaptable, etc.)? Moreover, how does this initiative relate to other processes in your company?	Company A	We have yet to have a specific innovation initiative that we carried out.
	Company B	We are making R&D indexed to meet the demands of our customers. Therefore, flexibility is decreasing; we must fulfil customers' needs and requests.
	Company C	What we call innovation or/and R&D is something more fundamental. What we do much more often is adaptive solutions. We usually do not call it innovation; we call it product development. We customise the answers by changing the shape-schematic functions according to customer requests.
	Company D	Our R&D activities are as piecemeal engineering works. We strive to make the products we develop generally adaptable. So, it can be used elsewhere as much as possible.
Q4. How does your company carry out the planning and control stages of innovation processes?	Company A	We have yet to follow any plans because we are a firm trying to stand on its feet. SME-sized companies like us, unfortunately, need help managing these processes correctly or knowing. That is somewhat driven by the company's manager's or employees' vision, but it will take time to establish a corporate form of it in a management style.
	Company B	Our R&D planning is shaped within the scope of the nationalisation program of public defence industry companies. We have products that we plan to sell abroad. However, this type of R&D project remains in the background. Cause the primary motivation is to survive. We prefer to invest in products with a market instead of more innovative products that are risky in marketing.
	Company C	There is an R&D representative in our company; we have a meeting about all departments that we call a monthly management review meeting. That is just a meeting with managers. There is a weekly business plan follow-up among them. However, we do the general proceedings once a month, and when we do it once a month, it is about every department, including R&D and Innovation.
	Company D	First, our overall R&D process has a plan. It has it is quality and process flow chart. We use this. Secondly, we adapted our R&D process to the project we received. We are preparing a project plan for this, and we plan workforce, equipment, devices etc., to be used in this project plan. We try to comply with this throughout the project.
	Company A	The documentation process is done regularly. These documents are recorded or revised at annual management review meetings.

Q5. How is the documentation process (archive, etc.) carried out regarding the innovation management system?	Company B	Our projects are recorded in a particular folder so our relevant personnel can access them. All phases of the project are archived.
	Company C	ISO 9001 is more superficial. It starts with a business idea in aviation. It is imperative to determine how the business will be managed and how it will be documented. Our R&D department has staff responsible for verifying processes by AS9100 standards.
	Company D	Initial planning is done regarding all our projects' design and production processes, and documentation is created throughout the process. Later, if the R&D project turns into production, this documentation is transferred to production and kept in the production network. The information remaining in R&D is stored in our design network, specifically for the project, on the design side.
Q6. Do your company learn from failures in innovation management?	Company A	At least 6-7 out of 10 R&D activities fail. We encounter failure in most of the things we do, but when we sit down and analyse the reason for failure, we learn the way to success.
	Company B	We need more than saying that our product is perfect. The customer should not like the product. Therefore, we consider customer requests as R&D. This is what we learned.
	Company C	There are such examples. Did you learn from this? This is not something that will make us give up on R&D.
	Company D	There are some projects we fail, but only a few projects. There are things we need to catch up with in engineering. Apart from that, there are also solved problems. We have a particular system in which certain documents exist. Successful or unsuccessful issues are documented. Newcomers also use that information in general in their new projects.

The third set of questions addressed other issues related to ISO 56002 standards concerning companies' innovation processes, such as relationships with stakeholders or competitors and strategies for collaborating with partners. The questions in this set are illustrated in the figure below.



The table below summarises the companies' responses to the third question set.

Question Set:3	**Answers Given**	
Q1. How does your company follow up on your competitors, competing technologies and intellectual property rights? How are	Company A	In Turkiye, there is no competitor company in our field. We first conduct a literature review for our competitors in the world. We are examining whether a patent has been obtained or not. If a patent has been received, we look at what we can do as an alternative to this and what kind of processes we can do. Then we move on to the product development processes.
	Company B	It is essential to be fast in competition with companies. Because every company follows the need, and if you do it first, the customer becomes a little attached to you. The most important thing in competition is that when we are successful in the test processes, and you satisfy the customer, they prefer your product.
	Company C	Our industry has some advantages. We are different from many industries. We are in an industry with less competition or even more qualified competition. So we know each other, and we talk to each other too. If the topic is R&D, competition may even be easier on the high-production side. Therefore, there is

opportunities for innovation identified?		no difficulty in following domestic competitors. They follow us; we follow them very quickly. If the competitor is foreign, you must look for the products and find the parameters of the comparisons related to this competition; you have to deal with it. Since our products are a complex structure that includes software and hardware, we call that review a benchmark. If there is a patent, buy it; if there is a product, buy it. If you need to travel, go on a business trip, or go to the fair.
	Company D	These are mostly done with one-on-one relationships. That is how we follow our competitors. We evaluate the opportunities according to the impressions we get from those conversations.
Q2. Does your company provide the necessary training/certification to its personnel working on competitiveness?	Company A	Investing in R&D or Innovation for SME-sized companies is generally seen as commercially risky. We are trying to overcome this, but we need a personnel assignment.
	Company B	We do not have such a study. We ensure that our employees are at a level to compete at a sufficient level. But we do this to do our job better and more appropriately. So, we do not have special training for this.
	Company C	We need personnel related to competitiveness. In other words, we do not have personnel under this title. We do not have any training under this heading. As a business development, there is a position called program management. Business development, marketing and sales activities are carried out here. If these personnel compete in their jobs, they must follow the process and submit reports. That is how we manage the competitive process.
	Company D	No.
Q3. Does it work in areas such as strategic intelligence, intellectual and property rights and copyrights, brands, trade secrets, open access licensing, etc., regarding the innovation management system?	Company A	We have an opinion about all of them, and we know them. But no planned and programmed work is carried out on any of them.
	Company B	The developed product must be documented. We obtain a domestic product certificate for the products we create. Apart from that, our company's trademark has been registered, and we patent the products we have developed under this brand name.
	Company C	For us, this process has two aspects. One is about patenting our work outside; we have to divide this into two categories, defence and civilian. We have yet to receive patents in security so far. But we have patents in civilian applications. We have experience in selling or buying intellectual property rights.
	Company D	Most of what we have done so far has already been customer-owned projects with intellectual and industrial rights on the customer's side. We make engineering rather than R&D. Of course; we add innovative things to it within the limits of what the customer wants. We have our internal projects; of course, we need to catch up with them from other projects. When we finalise our projects, we will do the necessary work on issues such as patents.
Q4. Does your company carry out partnerships and collaborations on innovation management?	Company A	No.
	Company B	Yes, we carry out the partnership with companies and academicians. There are companies we work with in the technopark. Additionally, we do not make some mechanical parts of our products. There are companies that we work with for these.
	Company C	We are a manufacturing company. In the electronics industry, the product industry is multi-layered. Now there are the software, hardware, mechanics, industrial design, and other various components related to production. However, we are in Technokent due to our insistence on being in this ecosystem. We choose many subcontractors from here. We find it valuable to be in the technology ecosystem and use it a lot.
	Company D	In some projects, we used collaborations with universities. We also received consultancy services. Information sharing with other companies is constantly happening. We are in constant interaction, especially with our subcontractors.

Q5. How does your company communicate about innovation processes with external stakeholders (customers, partners)? How is the feedback received?	Company A	We receive feedback from public defence industry companies on the test processes and application processes of the product we have developed. If there are negatives in line with the feedback, we analyse the reasons for this and reflect them for the products we will grow again.
	Company B	We receive feedback from public defence industry companies both on requests and validations. We do the tests together; we examine the returns of the tests together. While the product development process continues, it is necessary to discuss them step by step.
	Company C	Our projects have phases; each phase has milestones, and each milestone should have an output. That is an interactive process. Sometimes something comes out for you to reach that milestone; something has to come from our external stakeholders, such as customers, partners, etc. We call this interactive process "feedback."
	Company D	People in the project team provide communication with the customer or supplier. The necessary communication conditions are defined in the job description of each project. Matters regarding meeting periods and document sharing are determined.

5. Evaluation

The companies interviewed within the scope of this research carry out innovation activities at a certain level. Despite this, they all needed to familiarise themselves with the ISO 560002 standards. One of the primary reasons for this situation is that the ISO 56002 standard is still relatively new. It is predicted that this Standard will spread over time. The fact that the companies interviewed allocate budgets for innovation is the most crucial indicator of this prediction. During this research, it was considered that companies have a certain level of awareness about innovation. Furthermore, it is evaluated that companies are willing to advance the innovation processes.

Companies have been shown to learn from failures in innovation management. According to research, companies have a positive attitude toward collaboration opportunities in innovation management. It has been noted that the documentation process (archive, etc.) associated with innovation management is generally attempted to be carried out by AS9100, ISO 9001 and ISO 27001 standards. That demonstrates that companies are adhering to the standards with which they are compliant. This situation supports the theory that if a certain level of awareness is created and regular inspections are performed, the ISO 56001 standard will be implemented as well.

Companies are considered to invest in physical or virtual infrastructure where innovation processes can be carried out. Accordingly, companies require a vision/strategy or/and management policy through which their innovation processes are carried out. It has been observed that the concepts of R&D and Innovation often need clarification with each other. Therefore, companies' executives and employees must receive extensive training on terminological and methodological distinctions between these two concepts.

6. Conclusion

DAI is one of the world's pivotal and strategic sectors due to its unique distinction of being the locomotive of technological and economic progress. That is the reason why countries place a special emphasis on DAI investments. The world's current developments indicate that investments in DAI will continue to increase. This remarkable fact demonstrates that DAI will be one of the most outwardly visible dimensions of global competition in the coming years.

Turkiye has recently held a unique position worldwide with its outstanding investments in DAI, primarily in UAVs and UCAVs. DAI investments which prominent public and private companies mainly make with public financing, have elevated Turkiye to the forefront of the global competition in this sector. With these developments, a large ecosystem in the field of DAI has emerged in Turkiye. The SMEs that supply large DAI companies as subcontractors are undoubtedly the most vital components of this ecosystem. As a necessary consequence, improving SMEs' innovation management capacity is not only critical for the success of national-scale projects but also a matter that must be addressed in terms of global competition.

The innovation capacities of companies that are members of OSSA, Turkiye's one of leading Defence and Aviation clusters, were attempted to be analysed in this study. During the interviews conducted as part of this research, it was determined that companies have the potential to carry out promising successful works if they are accurately guided in the field of innovation management. Without a doubt, the most crucial priority of these companies is to be a subcontractor of large public DAI companies, to sign new contracts with them and to fulfil their commitments by making a profit with certain/limited sources. Expecting these companies to progress in innovation management with their resources will be unrealistic in this commercial cycle. Awareness and implementation of innovation management should be handled on a macro scale and should be planned independently of these companies' microscale economic priorities. In this context,

large public DAI companies and OSSA bear significant responsibilities. OSSA should provide managers and employees in its member companies with training on matters relevant to the global competition vision, such as innovation management.

Large public DAI companies should provide administrative and financial support for SMEs' innovation management activities. Instead of the lowest price being the most crucial criterion in large public DAI companies' purchase/procurement process, new models should be determined that will support strategic topics, particularly IMS, which will pave the way for innovations. The IMS:56002 Standard should evolve into a mandatory document requested in purchases and controlled/inspected in specifications, similar to other ISO standards, such as information security management systems and quality management systems, as well as other standards requested in specific fields and purposes. Only when all stakeholders widely accept IMS in the DAI ecosystem will it be at a sustainable level that can compete with the rest of the world. Global competition can only be achieved through macro-scale public policy at the level of the Defence Industry Presidency.

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