

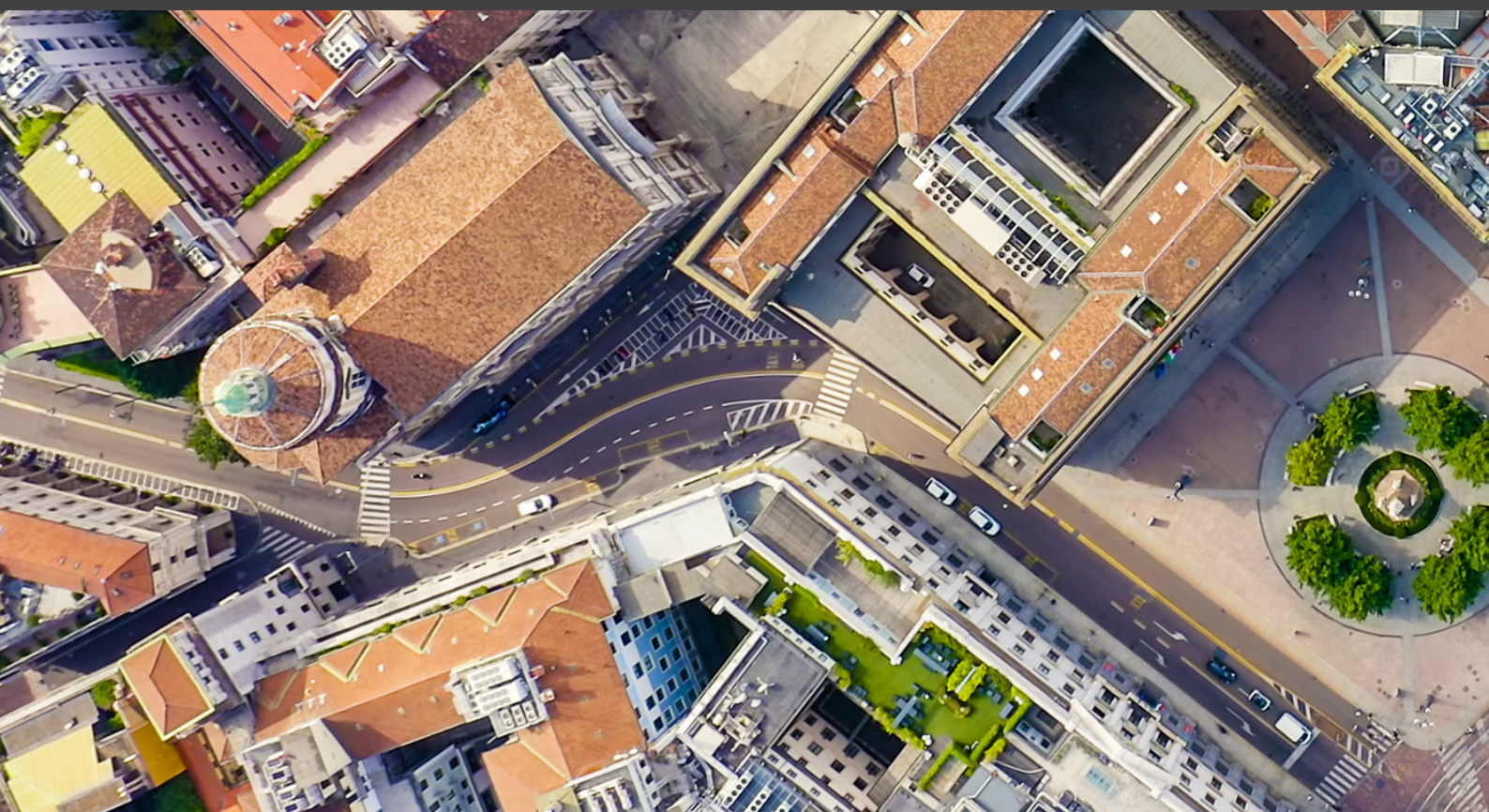
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Advanced Air Mobility (AAM)

Italian Market Study
& Recommendations
for the National
Ecosystem

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1. Foreword

With Advanced Air Mobility (AAM) we identify the large family of applications based on manned or unmanned drones and eVTOLs (electrical/hybrid vertical take-off and landing aircraft) that will offer innovative services for passengers and goods transportation, data and image collection and aerial work. Therefore, we are looking at the broad “drone market” encompassing recreational and professional Unmanned Aerial Vehicles (UAVs), new aircrafts for passenger transportation and cargo delivery typically over ranges below 300 nm, as well as the unmanned aircraft defense applications. Following the previous publication by Strategy& “The path towards a mobility in the third dimension - How to create a National ecosystem for Advanced Air Mobility”, this report aims at taking a deep dive in the Italian market to assess its maturity and projected trajectory.

Each AAM sub-sector faces a number of challenges such as autonomous flight, the availability of infrastructure (i.e., vertiports), integration into the current airspace regulations, and competition with other means of transport. Over the past decade, significant steps forward have been made globally in technologies enabling the development of advanced vehicles and aircrafts based on hybrid and electric propulsion systems. This, coupled with the expanding consumer market, resulted in several

players and start-ups investing in the development of drones and piloted vehicles capable of conducting complex operations in different environments (e.g. urban and rural).

The Italian ecosystem is continuously growing thanks to the great interest coming from both industrial and public entities that recognize the great potential of these applications bringing mobility and conventional ground operations to the third dimension. The identified challenges and their associated disruptive potential, call for a solid national ecosystem capable of providing full scale integration of mobility plans, identifying new sets of regulations and developing required technologies in terms of vehicles, systems and infrastructures.

To achieve these objectives, at Strategy&, we have identified market trends and gaps to develop a set of recommendations for the full range of interested stakeholders to propel the take-off of the national Advanced Air Mobility ecosystem.



2. The current context of Advanced Air Mobility

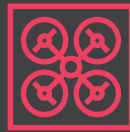
2.1 Perimeter of Advanced Air Mobility applications

Advanced Air Mobility services can be used to respond to a variety of needs adopting different technologies and types of drones and eVTOL aircrafts. Recent technology and regulatory advancements are leading to a constantly growing number of applications. Therefore, to better investigate market trends and peculiarities, we identified over 40 applications and rationalized them into five main clusters based on the target mission.



Passenger transportation

Solutions which include a variety of applications, such as air taxis, first aid solutions or entertainment activities.



Movement of goods

Performed through Unmanned Aerial Vehicles (UAVs) which is particularly useful to conduct the last mile deliveries to remote and poorly connected areas and in support to the delivery of medical equipment, with first examples emerging during the COVID-19 pandemic.



Images and data acquisition

With the aim of inspecting and monitoring infrastructures and sites as well as mapping and surveying of areas such as agricultural fields.



Aerial work

Which foresees the UAVs to physically interact and complete actions with the world around them while in-flight. Major applications of aerial work include performing maintenance activities, collecting objects or carrying out farming activities such as spraying water or fertilizers over fields.



Defence

Solutions which include all applications related to military and homeland security operations.



2.2 The Advanced Air Mobility Italian Market

Currently totaling a market size of €363M, the Italian AAM market is set to reach €1,8B in 2030, experiencing a 25.6% CAGR in the period 2022-2025 while a slightly lower 20.6% CAGR is expected for the 2025-2030 period.

A rising number of initiatives, sponsored by end users and major infrastructure providers, will serve as a catalyst for the growth of the Italian market. The emblem of this expansion for the next decade will be the passenger transportation sector.

The five missions previously identified unevenly contribute to the overall market acceleration. As leading startups will deploy their solutions, passenger transportation will be the protagonist, reaching an industry share of 36% in 2030 and growing at a 74.5% CAGR over the next 8 years.

Despite slower growth, visual and data acquisition will maintain its leading role with a current share of 55% falling to 38% in 2030. Partially boosted by the expanding consumer market, with international players set to increase penetration into the country, the data and image industry will also see a thriving industrial base, with an increasing number of initiatives aimed at testing inspection and mapping services.

Furthermore, although previous forecasts have been bolstered by recent conflicts, the defense mission will experience the lowest growth, with a CAGR of 14.1% and a fall in industry share from 32% in 2022 down to 17% in 2030; as expected from a maturing civil market.

Despite promising growth prospects, the remaining missions, Movement of goods and Aerial work, will continue to represent a rather small segment in the Italian market, the former being strongly dependent on large scale industrial initiatives and regulations, while the latter mainly subject to innovative applications in the agricultural sector. It is worth highlighting how, for cargo applications to report the second highest CAGR of 18.5%, effective and timely implementation of BVLOS

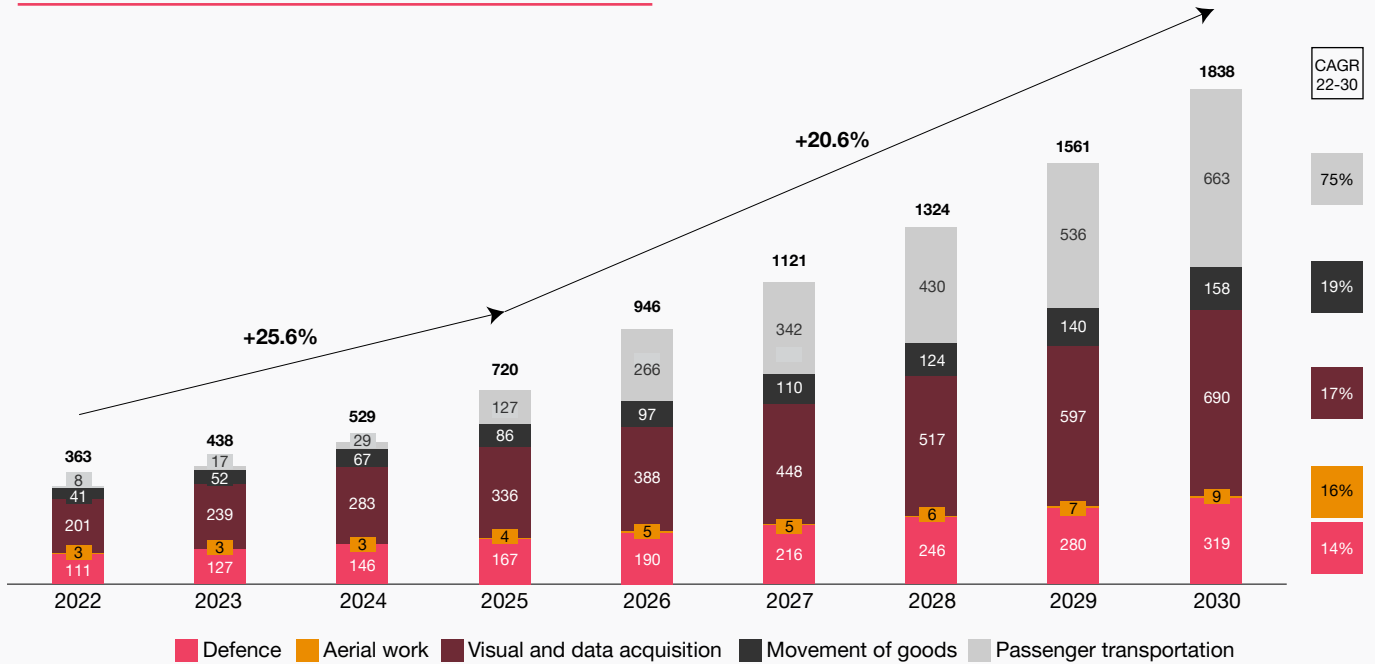
and airspace regulations is required to enable urban and extra-urban applications.

Considering the early development stage of the industry, R&D expenditure is included in the overall market size to better capture investments and trends. Zooming in on R&D, we forecast total investments growing from €106M to €267M, reporting a CAGR of 12.2% between 2022 and 2030. Comparing this with the ones above, we observe that R&D spending grows slower than the overall market across all missions. Moreover, the steep deceleration between the 2022-2025 CAGR of 19% down to 8% after 2025 depicts the criticality of current investments, called to define the market evolution trajectory to then rise at a lower pace once revenues increase.

Looking at individual missions, visual and data acquisition is expected to dominate R&D expenditure, with a large number of small players investing in new payload technologies and analytics. Although slightly lower in size until 2026, Urban Air Mobility will boost R&D spending with passenger transportation being the fastest growing mission. Defense spending, instead, is expected to rise steadily with emerging interest in joint military drone programmes for surveillance and combat operations such as the European MALE RPAS.

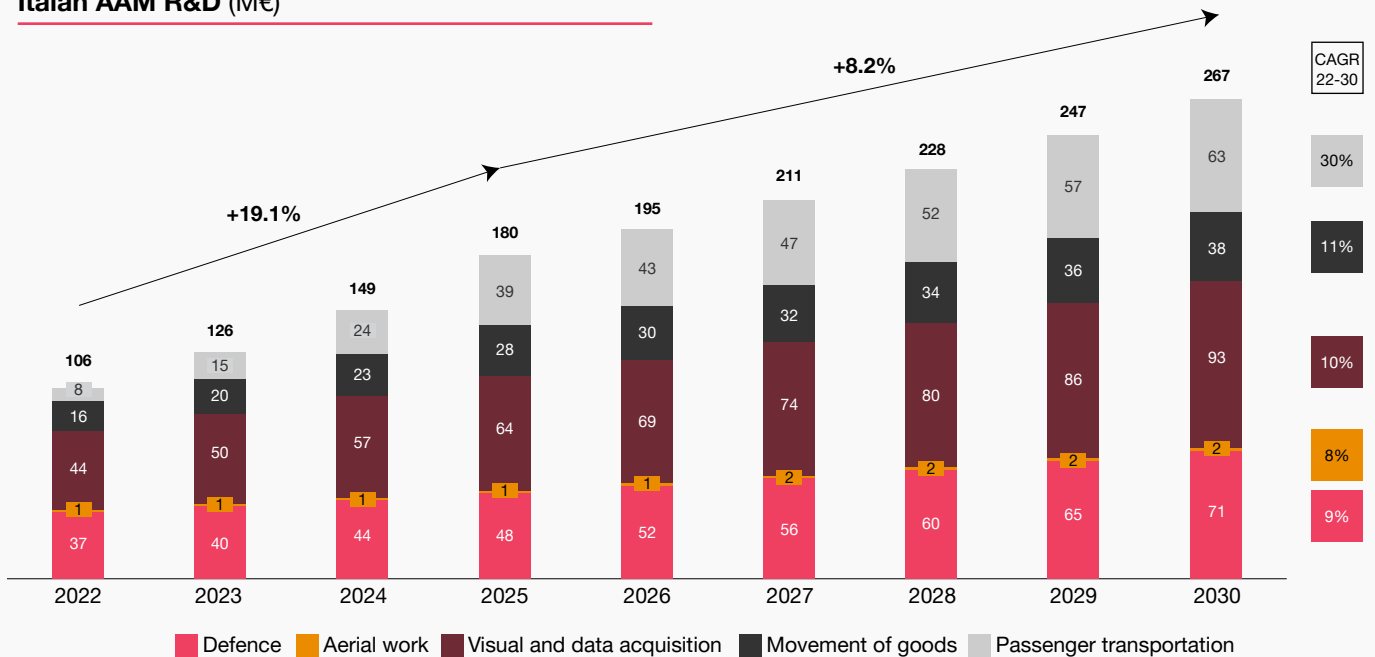
It is interesting to look at the weight of R&D on the total market size starting at 29% and halving by 2030. Although common across all missions, the drop will be mainly caused by the UAM sector, with players operating in passenger transportation and movement of goods investing a lower portion of their revenues as sales increase. Within UAM, while the overall decline is mainly due to the lack of a domestic industry leader, strongly impacting the passenger transportation sector, movement of goods will see a more resilient growth, combining both large and small scale applications.

Italian AAM market (M€)



Source: PwC Strategy& analysis

Italian AAM R&D (M€)



Source: PwC Strategy& analysis

2.3 The maturity of the Italian Advanced Air Mobility landscape

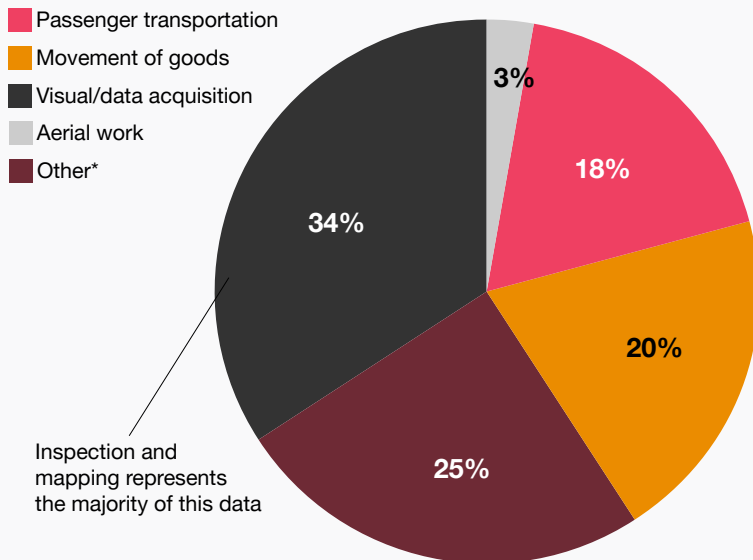
Having observed the national landscape and the promising future ahead, it is critical to place Italy on a global scale to grasp the maturity level of the AAM market by looking at ongoing activities, such as trials & initiatives, industrial players, investments, geographical suitability and implementation readiness.

The reported market expansion is indeed characterized by the proliferation of initiatives aimed at the development of systems and services with both public and private institutions collaborating with technological partners. As shown in the figure below, more than half of mapped initiatives entail inspection and mapping operations for infrastructure-heavy players, and trials to integrate ATM and UTM regulations and procedures, currently posing one of the biggest market obstacles.

Mapping Italian industrial players by size and focus demonstrates their distribution within the AAM sector and allows us to assess the maturity level of the domestic market. More specifically, Italian players have been categorized by reported revenues and estimated fraction of revenues related to AAM products.

The map puts ourselves in front of a vibrant market with numerous startups betting on AAM, thus foreshadowing a favorable landscape for future M&A operations. However, the low number of medium and large players with a high AAM focus indicates a modest market maturity level and may prevent the Italian industry from competing at the international level. The cluster of large industries with a medium AAM focus includes large software developers and structural components manufacturers currently expanding their product portfolio by supplying international AAM system integrators. Setting the map

Distribution of national initiatives by mission

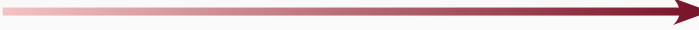


*Other mainly refers to trials developing ATM and UTM. Defence initiatives are not disclosed publicly.

Source: PwC Strategy& analysis

Companies focus on AAM market

Percentage of companies		FOCUS on AAM market			
		Low (AAM Rev < 5%)	Medium (AAM Rev < 30%)	High (AAM Rev < 60%)	Full (AAM Rev > 60%)
Size	Start-up (Rev < 0,25M€)	<1%	<1%	~2%	~25%
	XS (0,25M€<Rev<0,5M€)	<1%	<1%	~2%	~15%
	S (0,5M€<Rev<1,0M€)	<1%	~3%	<1%	~15%
	M (1,0M€<Rev<5,0M€)	<1%	<1%	~2%	~10%
	L (5,0M€<Rev<50,0M€)	~3%	12%	~3%	<1%
	XL (50,0M€<Rev)	~3%	<1%	<1%	<1%



Increasing number of players

Source: PwC Strategy& analysis

against R&D spending, we can confirm a large number of investments from small players directed towards low capital intensive applications such as visual and data acquisition. Contrarily, only a few players are involved in more complex, CAPEX heavy industries such as UAM, with the majority of XL players focusing on defense applications.

Examining the distribution of the above map at a global level, the largest discrepancy consists in AAM leading countries seeing eminent startups drive large R&D investments for air passenger vehicles development.

The current interest in Air Passenger Transportation also emerges when looking at the trend of investments from 2010 to 2022 with increasing deal number and size for funding collected by startups. With 2021 reporting record investments, 2022 is expected to confirm the positive trend, although not matching 2021 levels. It is to be highlighted that this trend is dominated by established and renowned players such as Joby Aviation, Archer aviation, Lilium, Xpeng, Volocopter... with over 96% of the disclosed investments flowing into four main countries: US, Germany, China and the UK. In this scenario, it is clear how Italy currently does not present a developed VC market to support growth of Air Passenger startups; investments by Italian players include Atlantia's in Volocopter (two rounds of €15M and €35M in 2021 and

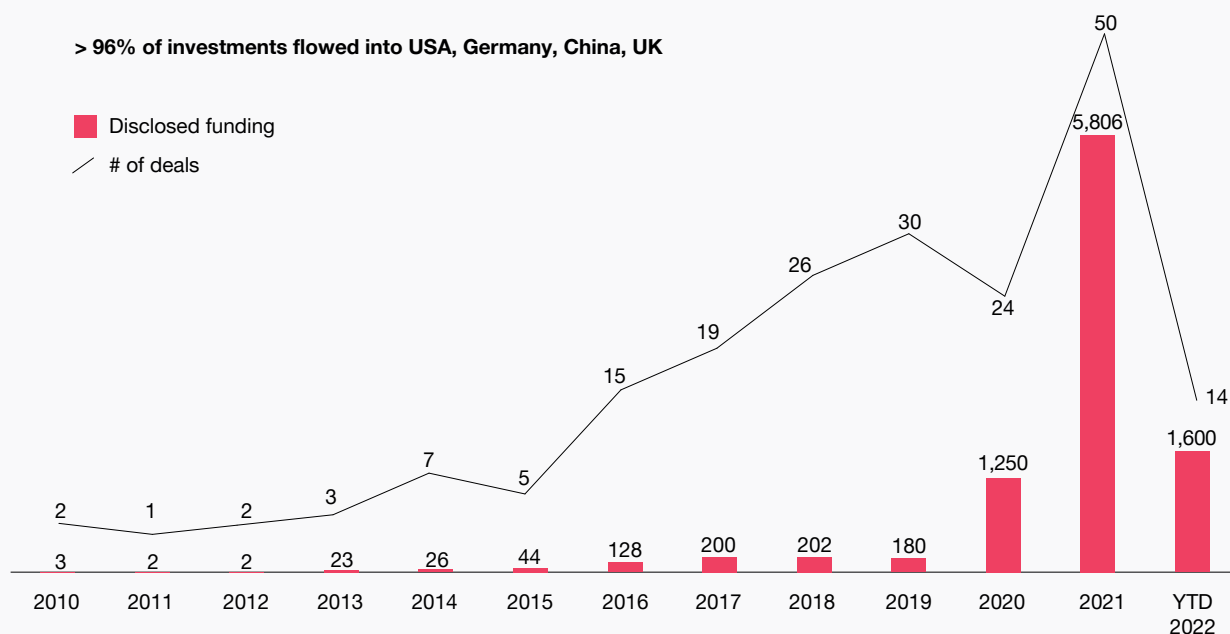
2022) and F2i's in Skyports that collected a total of \$23M.

The identified gap translates to the Italian ecosystem showing an infant maturity level when compared to Europe. This is demonstrated by comparing the Italian share in Europe for both the AAM market and a standard metric such as the GDP, as shown in the figure below. While Italy accounts for a large portion of the European GDP, at 14,4% in 2022, the Italian AAM market only represents 4,7% of the European one. The projected growth of the Italian AAM sector, at 22,5%, is set to change this situation, with Italy reaching a share of 6,4% in 2030. Although still less than half of the GDP share, this corresponds to an almost five-fold increase of the AAM weight on the total national GDP.

This growth and the successful outcome of the analyzed initiatives confirm the results of the latest EASA study on the acceptance of the UAM market in Europe, reporting at least two Italian cities in the top-10 ranking for the three main air passenger transportation use cases. The study highlights the high suitability of the Italian environment to air passenger applications by assessing feasibility and projected benefits of offering air passenger transportation services for airport shuttle, sightseeing and trips within the metropolitan network.

Investments in air taxi start-ups (M\$) and number of deals (# of deals)

> 96% of investments flowed into USA, Germany, China, UK



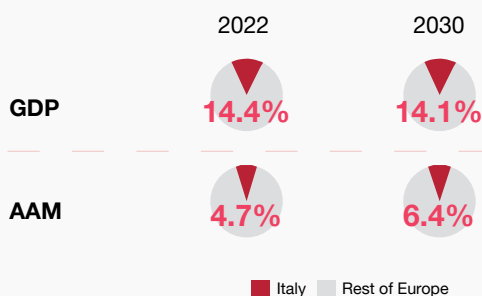
Sources: TNMT (Travel and Mobility Tech); PwC Strategy& analysis

In synthesis, reflecting upon the size of the Italian AAM market with respect to the European landscape, it is clear that high potentiality can be unlocked in the near future by leveraging the suitability of the national ecosystem and its current infant maturity level.

To capture this potential, we looked at leading countries in the AAM market such as the USA, the UK, France and Singapore, demonstrating successful development of key market enablers. Benchmarking studies highlight the common success factor being the empowerment of an established multi-stakeholder working group enabling the coordination of a national roadmap.

Italian AAM market vs European trends

Key metrics



Italy CAGR

2022-2030

2.3%

22.5%

Comments

Italian share on EU GDP is **expected to remain stable**

The Italian **AAM share vs Europe is 1/3 of the GDP one**

AAM/GDP ratio

0.017%





0,081%

x 4.7

Italian AAM share on Italian GDP to **increase ~5x**

Source: PwC Strategy& analysis

Roadmaps implementation strategy in leading countries

Country	Responsible actors
 USA	NASA, Federal Aviation Administration, U.S. Airforce, UAS Integration pilot program
 UK	Civil Aviation Authority, UK Department for transport, UK Department for Business, Energy & Industrial Strategy, CATAPULT
 France	Paris Region, RATP group, Group ADG, Airbus, Airfrance
 Singapore	Singapore Tourism Board, CAAS, Ministry of transport, SLA, EDB, VOLOCOPTER

Source: PwC Strategy& analysis

2.4 Identification of key gaps and challenges for the realization of the ecosystem

Current data and forecasts for the Italian AAM market, coupled with a full understanding of its maturity level in relation to the global landscape, allows to identify four main takeaways:



1. Unlocking potential

Although Italy is quite lagging behind global and European standards, the environment's suitability and strong potential could guarantee a growth above average until 2030. This is subject to the ability to leverage R&D investments and capture private and public funding to support the development of the AAM products and services.



2. Balancing industry share

The current industry distribution between missions is not representative of a mature AAM market. However, current trends will lead to a greater balance among the five mission clusters as passenger transportation leads growth, capturing share to the detriment of image and data acquisition and defense.



3. Lack of domestic development

Italy is lacking established industrial players developing products for the UAM and consumer markets. The numerous small domestic companies focusing on AAM require adequate financial support to grow and enable the Italian ecosystem to compete at the international level.



4. Coordination at national level to set up enablers

As stated above, analysis of leading countries in AAM highlights the presence of working groups composed of institutional and industrial players empowered to coordinate the implementation of national roadmaps and drive progress in technology and regulation.

3. We have identified a set of recommendations

Bearing in mind the identified challenges we targeted a set of recommendations to act upon in order to accelerate the Italian market evolution:

1

Support the implementation of the national roadmap

2

Strengthen the Italian AAM ecosystem

3

Leverage European and national funding

4

Develop key market enablers

If tackled simultaneously and by all key players, these actions will enable to unlock full market potential bringing to life a thriving national ecosystem.

3.1 Support the implementation of the national roadmap

In September 2021, ENAC published the AAM roadmap, along with strategic and business plans to guide the evolution of the Italian AAM maturity level for the next 10 years. Three main waves with associated maturity levels have been laid out starting with demonstrations in controlled environments to then reach medium complexity operations within dedicated corridors by 2030.

Eight main clusters have been identified to accelerate the implementation of the roadmap (for more detail please consult “The path towards a mobility in the third dimension - How to create a National ecosystem for Advanced Air Mobility”):

- **Airspace design for UAS integration**, referring to the design of layers, zones and airways to ensure safe use of airspace;
- **Workflow Automation for Mission Approval**, to ensure digital and automated management of operational and mission authorization at scale in line with European regulation;
- **U-Space/ATM cooperation**, reducing interference risks between U-Space and ATM zones increasing the situational awareness cooperation;
- **U-space services consolidation**, to mitigate safety and security risks providing certified services to operators for mission execution;
- **Security**, progressively reducing the cyber security risks related to vehicles management and service platforms;
- **Vehicles enabling technologies**, to identify, develop and test the most promising technological solutions to address current capability gaps;
- **Platform development**, supporting the industrial ecosystem to develop prototypes and products of subsystems and vehicles;
- **Infrastructure, Planning and PMO**, to support AAM planning (PUMS, SUMS) and infrastructure development for tests, pilot services and early stage commercial services.

In order to address and coordinate such activities, demonstrations need to be conducted and deployed on existing testbeds on the national territory, industrial consortia require support for R&D campaigns, infrastructures need to be developed both through greenfield realization and conversion of existing assets. In synthesis, the coordination of trials, R&D, commercialization and infrastructure development requires a wide skill set and empowerment at national level, calling for the establishment of a strategic PMO team.



3.2 Strengthen the Italian AAM ecosystem

To invigorate the national ecosystem, collaboration among players is critical. In particular, partnership between AAM product developers and end-users can accelerate the establishment of a robust business environment. A close look at recent collaborations allows to outline interesting market trends. Looking at the early involvement of end-users, we are mainly observing leading aerospace and defense players partnering with AAM startups to support utility companies in a range of internal operations. The majority of initiatives consisted in the use of remotely piloted aerial vehicles to:

- inspect infrastructures and assess integrity for routine check-ups and/or prior to maintenance operations;
- topographical mapping for new development;
- cargo applications to transport components for electrical power lines are also witnessing increasing interest.

Although utility companies offer a great example for multiple applications, other end-users involved in recent initiatives include hospitals for the transportation of biomedical material and agricultural companies leveraging drones for precision agriculture applications.

Regarding the engagement of public institutions, we notice three main trends:

- Infrastructure providers and regulators collaborating to investigate ATM and U-space integration, often leveraging expertise from an industrial player;
- Infrastructure providers looking for support from public institutions and regulators to accelerate development of UAM infrastructure (e.g. vertiports);
- Research centers partnering with national institutions to set-up startup accelerators and capture funding required for technology development and public education.



3.3 Leverage European and National Funding

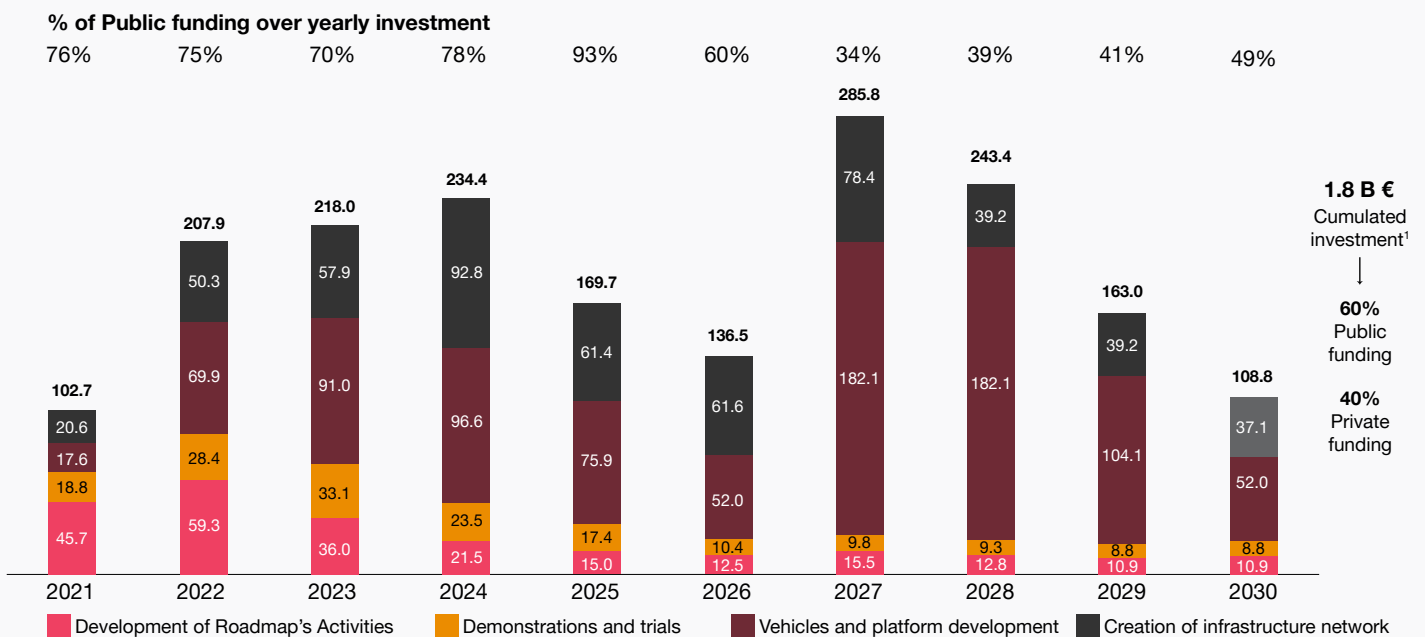
Public funds, both at national and European level, represent a strong push for players that are willing to expand and consolidate. For this reason, it is paramount to leverage existing resources to support R&D investments and accelerate market development.

Italy has established ministerial and regional funds for the development of innovative solutions which can be exploited by AAM players. However, the most representative and tangible signal from the government is the publication of the Italian AAM Roadmap with planned investments for €1.8B between 2021 and 2030. The strategic plan addresses four main categories, with the most funded being vehicles and platform development, receiving a total of € 923M. Furthermore, it is worth highlighting that public funding represents the majority of allocated resources, at approximately 60% of the planned cumulated investment.

To accelerate research and innovation in the region and deliver the Digital European Sky, Europe has allocated funds aimed at technological advancements. Among those are SESAR JU, EIB - European Drone platform, European Urban Initiative, Invest EU.

It is noted that even though a large amount of public funding exists, the majority of activities have originated in the private sector, with different categories of players taking interest in the market. AAM has surely attracted Investment Companies, Venture Capitals and Private Equity players such as Ardian, Antin Infrastructure Partners and F2i SGR but also infrastructures developers willing to adventure in an emerging market (ADR, SEA and Atlantia). Examples of partnerships and operations involving established industrial players such as Leonardo and Fincantieri represent further opportunities to capture funding from adjacent markets.

Total investment required (M€)



Source: PwC Strategy& analysis

3.4 Develop key market enablers

Such leading industrial players from the aviation and transportation business can sponsor opportunities and interact with national regulators, thus playing a strategic role in the development of AAM market enablers. Market studies identified seven key enablers for AAM which are being addressed by several initiatives.

Design of the airspace

- Integration of the airspace
- Identification of restricted zones
- Altitude restriction
- Identification of risks

Vehicle development

- Vehicle certification
- Continuing airworthiness
- Advanced systems and technologies

Vehicle's operations management

- Pilot licensing
- Flight above people
- BVLOS operations
- Autonomous flight
- Weather resilience
- MRO operations

Public acceptance

- Safety
- Privacy
- Impact on employment
- Environmental impact
- Noise and visual disruption

Infrastructure development

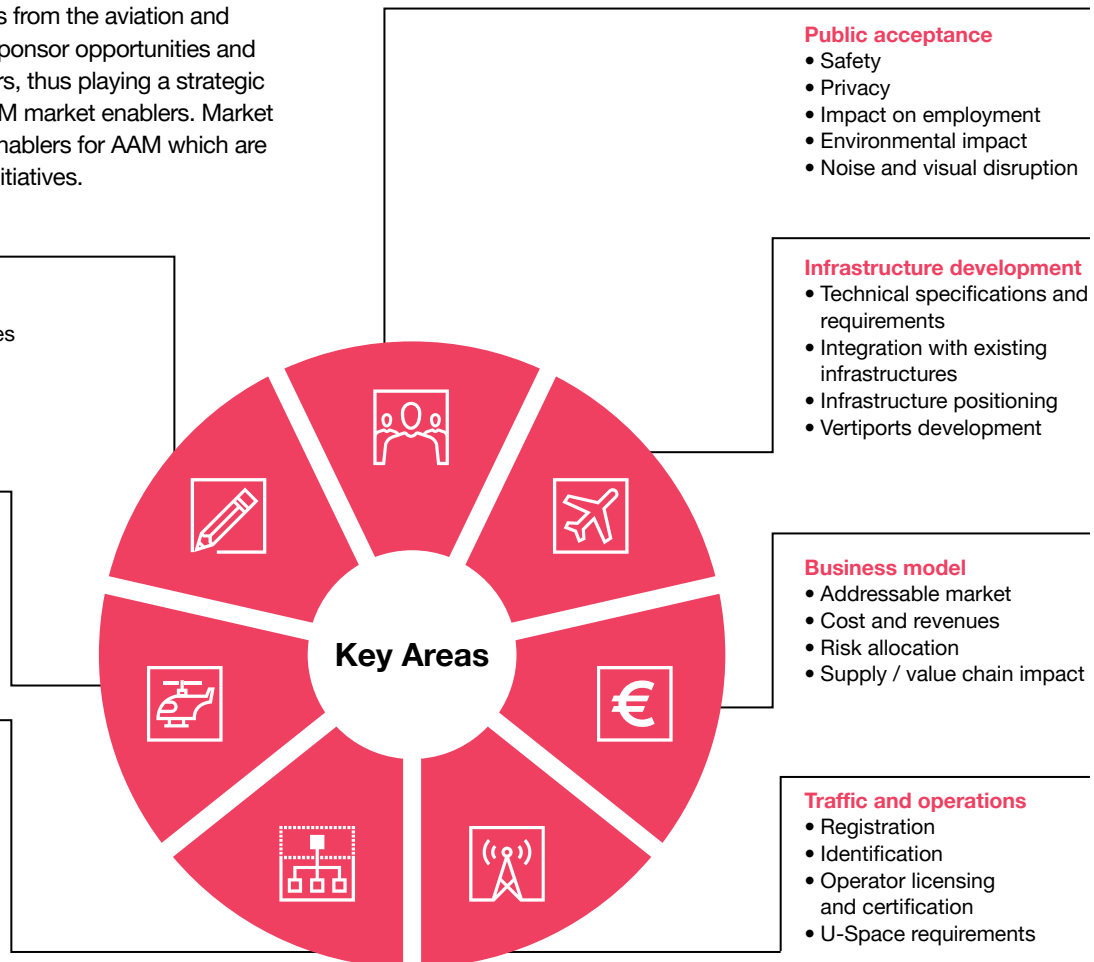
- Technical specifications and requirements
- Integration with existing infrastructures
- Infrastructure positioning
- Vertiports development

Business model

- Addressable market
- Cost and revenues
- Risk allocation
- Supply / value chain impact

Traffic and operations

- Registration
- Identification
- Operator licensing and certification
- U-Space requirements



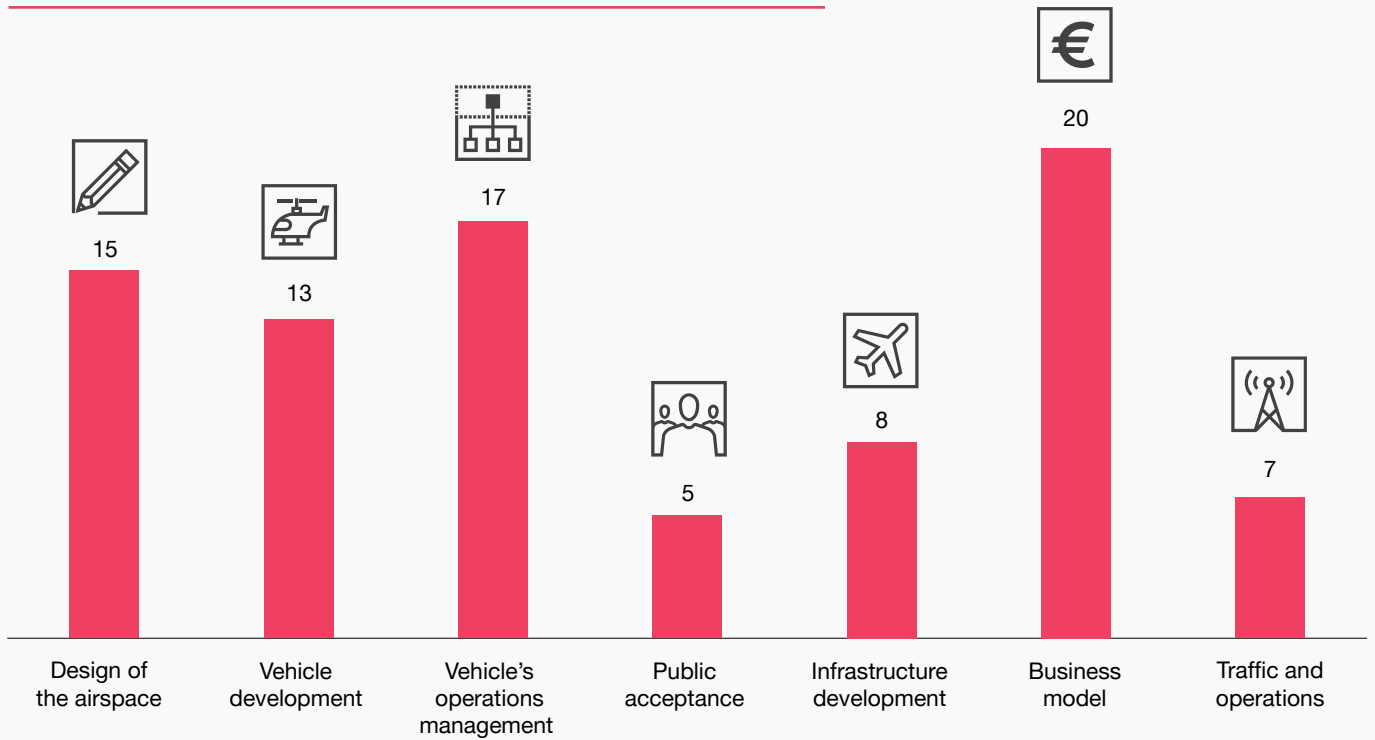
More specifically, breaking down the mapped initiatives by the target enabler, we see in the figure on the right a clear focus towards the testing of implementation services, indicating interest in assessing vehicles' operation and improving business models.

Moreover, as expected, airspace design emerges among the most tackled enabler as a large number of trials is required to fully characterize ATM and U-space coordination, allowing advanced operations and more efficient manned and unmanned missions.

It is also noted that, although the general public is mainly attracted by the consumer segment, industrial initiatives shall aim for greater public involvement to educate the population and foster acceptance of AAM in the urban context.

A major feasibility issue lies in the infrastructure development, which is currently only addressed by a few initiatives due to the high investment required. Complex partnerships are needed involving an existing infrastructure operator (e.g. ADR), a regulator (e.g. ENAC) and a vehicle developer (e.g. Volocopter).

Distribution of national initiatives by key enablers



Source: PwC Strategy& analysis





4. Closing remarks

The market analysis portrays a vibrant Italian market with a high growth potential over the next decade. Strategy& has identified four criticalities to act upon to accelerate the evolution of the national AAM ecosystem:

-
- 1** Mapped initiatives show successful collaboration models but are circumscribed to a limited set of applications. Full potentialities can be unlocked by supporting the national roadmap's implementation.

 - 2** Absence of a leading domestic UAM vehicle developer highlights the lack of private investments. Collaboration among players is critical to strengthen the Italian ecosystem and accelerate the establishment of a robust business environment.

 - 3** High market suitability calls for immediate action to maximize impact and project Italy on the international stage. Available public funds, both at national and European level, represent valuable resources to support R&D investments and accelerate market development.

 - 4** Full development of all market enablers is needed to drive progress in technology and regulation calling for large public investment and coordination at national level.

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