Axilion Smart Mobility - Update Report

04.04.2022

Stock exchange
TASE

Symbol
AILN

Sector
Technology

Sub-sector
Software

Stock price target
15.8 NIS

Closing price
3.11 NIS

Market cap
90 M NIS

No. of shares
29.1 million

Average daily trading volume
1,374 stocks

Stock performance (Since Jan. 2022)
-42.74%

Significant progress towards technological maturity; Completion of pilots in France and Italy; Continued technological progress; sufficient cash balance to support continuation of operations; price target remains unchanged.

Axilion is an artificial intelligence (AI) software company that **develops AI-based systems** to better manage **traffic mobility** in cities, thereby **reducing their carbon footprint** and **improving urban traffic safety.**

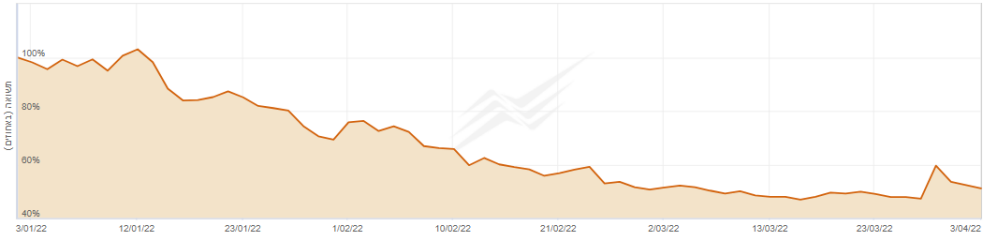
Major events and significant progress on several levels in Q4 2021:

- Significant progress towards high technological and business maturity.
- Success in two technological pilots (in France and Italy) of the company (based on X Way Pulse).
- Identifying target markets and partners.
- Promoting an outline on conducting a significant pilot in the US.

Strategy and business model - The company conducts pilots for its X Way Pulse product with Microsoft Azure as a strategic partner. Axilion is in the stage of technological feasibility and building the business model, and before the sales stage. Therefore, **there is also a certain risk involved in commercializing the company's services.** We identify difficulty in closing deals as the company's customers are mainly institutions (municipalities, etc.), characterized by relatively long sale cycles. Due to the Covid-19 outbreak, the mentioned customers, especially in the US market, are focusing their resources on issues related to health and fighting the coronavirus, rather than issues that were more on the agenda in the past like urban transport.

Recall that Axilion is addressing the AI-based traffic management market. We anticipate 2022 being the year in which AI systems will be deployed globally, utilizing the new infrastructure built into data centers. This will attract more investments in the coming years.

We will continue to monitor the company's progress in the coming months, and will update our forecast in line with company updates.



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Key events in the Q4 2021 and past months of 2022:

- The digital coordination system (X Way), which the company is developing, is expected to allow the modeling of a selected transportation axis in the city (corridor) and provide a recommendation for an optimal distribution of the duration of the "green time".
    - This system is in advanced stages of calibration, and validation, with the company estimating that during 2022, additional pilots will be completed under the company's management, in a way that will apply high technological maturity to the digital coordination system (X Way), which will promote business and strategic contacts In front of potential customers and partners with an emphasis on the US market.
- Recently, the company presented at a leading smart transportation international conference on the open architecture of the X Way system, which includes the flow of information to and from the X Way, and aims to support extensive collaborations with strategic partners, as well as presented a visualization of the X Way, and a user interface that simulates the optimization processes of dynamic traffic routes.

The company recently reported that significant progress has been made on several levels, implementing a business, strategic and technological focus plan, which has already achieved the following initial goals:

1. **Significant progress with high technological and business maturity** - the company announced that it estimates that, at the current stage, the X Digital Twin system has reached a very advanced level of maturity. It should be noted that the development processes have not yet been finally completed, but as stated, significant progress has been made.
2. **Success in two technological pilots (in France and Italy) of the company (based X Way Pulse)** - the pilot in France carried out in collaboration with Transdev, one of the major transport companies in Europe was successfully completed. This success was another significant step towards technological maturation of the company beyond the business phase and the promotion of advanced and complex pilots based on the Digital Twin System. The pilot in France, as well as the pilot in Italy, have been declared successful by the partner and the relevant cities.
3. **Identifying target markets and target partners** - after examination and research processes, the company reported that, in the company's assessment, the American market is the right market for its areas of activity and is a potential market worthy of quality penetration of the company's services and products. The company intends to focus on this market, and will work to promote collaborations with Go to Market partners who have been identified by it as suitable business partners and with whom the company is in advanced contacts.
4. **Promoting an Outline on a Significant Pilot in the US** - The company is pleased to update that there are recent advanced contacts leading up to a summary on a significant pilot in the US. To the extent that the said pilot matures into a binding agreement, the company will act and report, subject to any law. This is a pilot on a significantly larger scale compared to previous pilots performed by the company, a pilot that is expected to be performed with (and for) international scale partners (including a Tier One company) - this pilot, subject to its success, is expected to reflect business feasibility and form the basis of a future business model. In the company's target countries - based on the X Way Digital Twin system.

   It will be clarified that at this stage a binding or non-binding memorandum of understanding has not yet been signed with any of the potential business partners with whom the company is in contact or in connection with a pilot or promotion of any pilot. As long as there is progress in the contacts or the signing of the agreement, the company will act and report on the matter, subject to any law.

In conclusion, the company continues to develop its products, continuing to successfully complete its pilots in an effort to examine the feasibility of its products and their integration in transportation systems in various cities and is working to strengthen its business development capabilities. In our view, the decline in Axilion's market value in recent months reflects a reduction in the expectations gap between the company and the market, which expected the company to reach technological and business achievements at an earlier stage.

The company's financial statements show that it’s making efforts to increase transparency about the pace of technological development, pilots, and business activity by publishing schedules. Our assessment of the company's activity is based on these schedules. We estimate that the company has sufficient cash balance

Investment Thesis

Executive Summary

A significant share of global fossil fuel-based energy generation goes to the transportation sector. The combustion of fossil fuels, such as gasoline and diesel, releases carbon dioxide and other greenhouse gases (GHG), causing adverse environmental impacts, such as global warming and air pollution, that can result in respiratory illness in humans. Climate change due to global warming also has other, far more serious, consequences, such as disrupted monsoons (threatening the global food supply chain) and increased occurrences of natural disasters, such as drought. In 2020, in the United States alone, GHG emissions from the transportation sector accounted for 28% of total U.S. GHG emissions[1], making it the largest contributor to U.S. GHG emissions.

Driven by stringent environmental norms and increasing environmental awareness, industry participants across the globe have begun adopting technology solutions that enable them to adhere to zero-emission protocols. Electrification of the transportation sector is considered to be an important stepping stone towards a sustainable transportation sector; however, the electrification process entails its own cost and infrastructure-related challenges. Another approach towards reducing the carbon footprint of transportation networks is establishing congestion-free road networks and increasing public transportation utilization, as the carbon footprint per person traveling via public transportation is much lower than that per person traveling via private vehicle.

The traditional method of building interchanges, highways, highways and subways is expensive and time consuming. An alternative solution, consistent with the Fourth Industrial Revolution, is the automation of traditional industrial practices using smart, modern technological solutions. That is, the development of intelligent traffic management systems based on artificial intelligence, with a high adaptability to changes, capable of automatically managing the flow of traffic and prioritizing vehicles with fixed timetables (especially public transport). There is a real need for a traffic management system that is able to accurately predict traffic patterns in order to outline the optimal traffic light plan for the various cities. AI and deep reinforcement learning technology are ideal candidates for creating the possibility of establishing such smart traffic management systems.

[1] Source: United States Environmental Protection Agency

Deep Reinforcement Learning Technology for Autonomous Mobility Optimization

Saving time and resources, transforming the transportation network without costly infrastructure changes

Utilizing an AI Mobile Edge Camera, Axilion's technology solution (X Way Suite) is able to capture the road-traffic network and convert the collected data into actionable insights via X Way Suite's AI cloud services. The idea is to leverage the data collected from **AI-based cameras** via the proprietary **trained neural network** to determine the optimum traffic signal schedule across the network.

X Way Suite's advanced algorithms continuously analyze the incoming data from dashboard cameras and, in parallel, simulate the entire city's transportation network via a **digital twin**, where solutions such as **deep reinforcement learning AI** technology are used to run multiple tests and determine the most efficient traffic signal schedule for multiple intersections. Data collected from the cameras are streamed through Microsoft Azure's IoT hub, where Azure Edge's encryption technology is utilized for data protection and enhanced cyber security.

axilion
where traffic is going

powered by Microsoft Azure
IP Co-sell Partner

In addition to the above, the developed system leverages the fixed route of the public transportation system and onboard cameras to dynamically track the traffic pattern on a real-time basis and to change traffic light signals, prioritizing the movement of public transportation to reduce travel time.

The digitization of public transportation schedules and coordination with traffic signals creates a far more efficient public transportation network, where users can track the entire schedule from mobile apps or screens at bus stops, and plan their travel accordingly. In the long run, faster and more efficient public transportation networks aid in changing commuter preferences toward public transportation over private vehicles, thereby directly reducing the carbon footprint of the transportation network.

We view Axilion as a great opportunity for those seeking to invest in sustainable and smart mobility and specifically in a primary element of traffic flow management.

Company Overview

Axilion (TLV: AILN) hereafter "the Company" and/or "Axilion" is a publicly-traded AI software company headquartered in Israel and has offices in Israel, US, UAE, and Europe. The company focuses on developing **AI-based software systems** to better manage **traffic mobility** in cities, thereby **reducing the carbon footprint** and **improved safety**. In recent years, the company has been successful in implementing as well as in piloting its software solutions across multiple geographies: Israel, France, Switzerland, the United Arab Emirates, the city of Jerusalem, and the United States. In Israel, US, and Europe alone Axilion's solutions have been deployed at more than 1,000 traffic intersections.

Strategy and Business Model

The company's vision has primarily been towards leveraging AI capabilities to reduce the carbon emissions of the transportation sector. Traffic congestion is a challenge that contributes to millions of dollars in lost time and waste fuel across the globe. Further, the issue of traffic congestion is more frequent in urban centres than in rural settings primarily due to a larger number of private vehicles, commercial vehicles, and sometimes also due to heavyweight vehicles. Axilion has developed its X Way Suite specifically to address the challenges faced by urban centres with minimum required investment. The X Way cloud services are based on more than 10 years of the company's experience in developing and implementing traffic light program planning software - TransEm (the company's previous generation of products), which is used by more than 100 traffic engineers in Israel and around the world.

The company deals via Microsoft's existing agreement with government bodies where the Axilion X Way suite is provided as an add-on solution. For every camera installed, Axilion generates about USD 150-600 per month of Azure credit depending upon data requirements. Further, Axilion charges the city for managing the traffic patterns, whereas it takes a share of 50% of the cost incurred to the city for utilizing Microsoft Azure.

Additionally, the developed system is hardware agnostic and in the coming years is likely to be integrated with multiple types of sensors, which might be already present in a city's transportation infrastructure (stand-alone pedestrian traffic signals, speed gun detectors, and others) to ensure that at the least all the vehicles with a predefined route faces as fewer red lights as possible. For instance, the X Way Suite has ensured that the Light Rail in Jerusalem always passes through the green light, all the while taking pedestrian safety under

consideration. The end result was that the Jerusalem average commute time drastically dropped to 42 minutes from the previous 80 minutes, headway reduced to 6 minutes and the ridership increased by as much as 387.4%.

Products and Technology

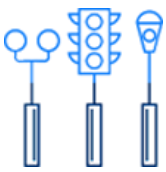
Axilion has developed artificial intelligence and deep learning traffic management technology through comprehensive research, and has perfected the system by conducting multiple tests in a variety of cities. In addition, the company actively cooperates with research institutes such as the Technion, Tel Aviv University and the Innovation Authority, for the ongoing development of the Suite X Way solution, which is based on TransEm software for designing traffic lights of the company.

Unlike autonomous vehicles that analyze the data input coming from multiple hardware units, which are physically located in the vehicle like LIDAR, RADAR and other processing units, the X Way package optimizes traffic flow pattern without changes to physical infrastructure and without any expensive hardware installation. An initial calibration of the traffic corridor requires the installation of a dashboard camera (equipped with a GPS sensor and a wireless connection) that enables real-time video analysis. In general, it is necessary to install a limited number of cameras for each new traffic corridor in order to calibrate the digital twin.

Axilion's technology contributes to cities by reducing average travel time, improving pedestrian safety, reducing air pollution, reducing stopping time at red lights, promoting the transition to using public transport, and thus improving quality of life.

Axilion's X Way Suite's key attributes

Deep Reinforcement Learning AI Technology



Maximize Existing Traffic Infrastructure

Real-Time, Adaptive Control

Smart & Scalable

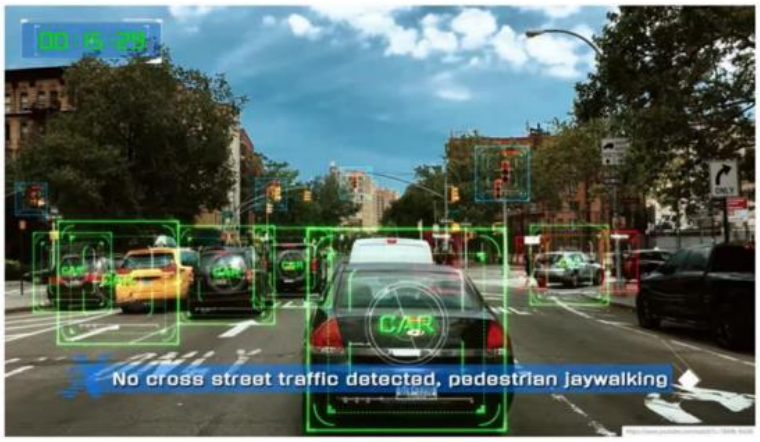
Hardware Agnostic

Efficient Simulation via Digital Twin

The company has three SaaS service offerings:

1) X Way Pulse

Cloud-based data collection system, which interacts with traffic infrastructure such as traffic light controllers, detectors, traffic cameras, etc. In most cases - the data required for the system is already processed (ie a camera with the ability to count traffic). If the available data is not pre-processed, the company uses cloud-based AI to extract the required information. As of the date of the report, the company has successfully completed and completed two completed pilots, in which the capabilities of the system were verified.



2) X Way Twin

Modeling of the transportation network in the city while constantly calibrating the model using the latest traffic counts and destination-destination matrix that are obtained from the monitoring system. The system is characterized by microsimulation, which allows a drop to the level of each vehicle at a resolution of every second. The system is cloud-based, and allows a large number of twins to run in parallel in a short time.

The computational efficiency makes it possible not only to assess the delays and level of service obtained for traffic light plans and different traffic conditions but also to optimize the various parameters and implement them in the traffic light plan. The simulation is capable of handling the various road users, on public transport, in a network of coordinated adjacent nodes including functions of transmitting information of detectors between the nodes, offsets, green waves in one or more directions of movement. Computational efficiency enables the system to offer real-time solutions that enable immediate responses to traffic challenges as well as forecasting future traffic conditions. The simulation is automatically calibrated based on data and metrics generated from the monitoring system.

3) **X Way Neural**

A system of recommendations that provides alternative traffic light plans for the city traffic light network based on a dynamic and distributed measurement of the levels of demand, the various vehicles, the capacity of the roads and the nature of the drivers' driving. The system is based on advanced reinforcement learning technology. This system is a holistic system and is another tier on the monitoring system and the digital twin system. The system provides an end-to-end solution for the entire process of planning traffic light plans for all stages from A to T. The optimization is carried out using unique algorithms in Deep Reinforcement Learning methods. The system receives as input the current traffic light plans and evaluates the situation, the quantities of vehicles and the nature of the traffic in the city at different times, using sensors installed on vehicles and scanning the traffic in the city. Based on this input, the system performs an optimization process aimed at

flowing traffic in accordance with city policy. Traffic policy may vary from city to city and between different areas of the city, depending on the purpose of the optimization that can be planned (for example - reducing general traffic congestion, prioritizing public transportation, reducing pollutant emissions). And at the end of the process, alternative traffic light plans are obtained, accompanied by a traffic simulation through which the quality of the solution can be examined. This system is in the research and development phase.

As of the date of the report, the company is simultaneously working to complete the experiments for the X Way system, and also from the company's databases it will be possible to build, together with the company's customers, a variety of services / products based on the company's databases.

As of the date of this report, the following is the status of the R&D activity of the various products:

- TransEm: The focus is on support and maintenance when the term "maintenance" includes both bug fixes and improvements and changes (features) that are required by users and customers. The company currently offers version 8.1 and updates versions from time to time and submits them to the Ministry of Transportation for approval, in accordance with standard practice.
- X Way products:
    - X Way Pulse - Two pilots in the EU have been successfully completed and completed as part of which the system capabilities have been verified.
    - X Way Twin - in the midst of field tests to verify and calibrate the simulation. Validation of technology as part of the ongoing pilot in Jerusalem.
    - X Way Neural - Product in development stages. The company is working to complete the experiments for the system.

Impact of Axilion's System Installation in Haifa (A metropolitan city in Israel)

Haifa was one of the first cities to adopt Axilion's TransEm, and the city upgraded its Metronit bus rapid transport (BRT) network by adopting Axilion's X Way Suite for 200 traffic lights along the bus route, for continuous and automated optimization of the traffic flow. In a short period, the BRT network witnessed roughly a two-fold increase in ridership (115,000 travellers from a previous 60,000 travellers per day), faster commute (average traveling speed of buses increased from 20 kilometres per hour or kmph to 26 kmph, whereas the average travel time decreased from 73 minutes to 58 minutes), less congestion, and enhanced pedestrian safety.

In addition to the above, there was a drop of 11% in the private vehicle utilization, an estimated annual savings of USD 7 million in operations and maintenance, along with an estimated 140,000 tons of annual CO2 emissions avoided.

Impact of Axilion's System Installation in Jerusalem

The tram network in the city of Jerusalem updated its 273 intersection points by Axilion TransEm for enhanced traffic management.

- Estimated savings due to reduction in fleet size: USD 600 million annually
- Estimated reduction in energy requirements of trams: 28%
- CO2 Savings: 100,000 tons annually (Primarily due to decrease in operational tram fleet size, increase in public transportation utilization, and decrease in private vehicle utilization)

	Before	After	Benefits
Travel time	80 min	42 min	47%
Number of trams required	32	21	34%
Tram frequency (headway)	15 min	5 min	66%
Number of Passengers	40,000	200,000	400%

AI in Traffic Management Market Overview

Artificial Intelligence has a strong potential to overcome the deficiencies in the automotive sector and provide significant benefits in terms of improved productivity and added revenue. AI acts as a crucial technology enabler in transforming every aspect of the automotive value chain starting from research and development to enhancing the car driving experience. In the automotive sector, a major chunk of the innovations is focused at streamlining the in-vehicle driving experience, whereas just a few are focused at the overall scenario of smart traffic management.

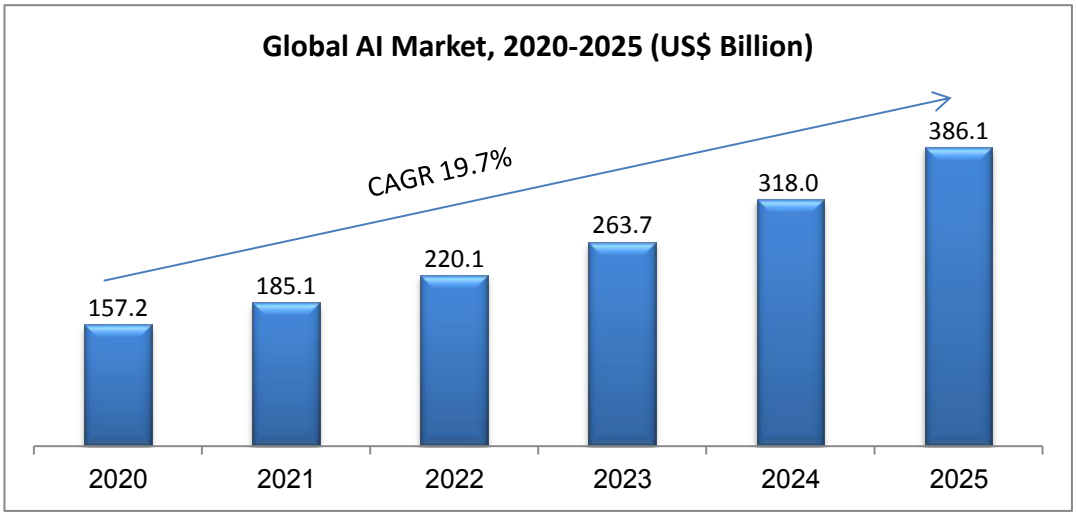
Traffic congestion is a problem faced by both the developing as well as developed economies, where AI powered systems for managing traffic lights is expected to be the most ideal solution due to its massive data handling and analysis capabilities. AI is considered to be a promising technology solution for transport authorities to achieve rapid improvements in relieving traffic congestion, improved travel time, and improved utilization of their assets for enhanced revenue generation, productivity, and lower carbon footprint. **Among the prominent players specifically catering towards technology solutions streamlining traffic flow across the city are: Nexar (Israel), Mobileye (Israel), Moovit (Israel), C3 AI (United States), Google WAZE (Israel), NoTraffic (United States). Rapid Flow Technologies LLC (United States), FLIR Systems Inc. (United States), Alibaba Cloud City Brain (China), Telefonaktiebolaget LM Ericsson (Sweden), and AIndraLabs (India) amongst others.**

Global Artificial Intelligence Market:

The global artificial intelligence (AI) market is expected to grow from US$157.2 billion in 2020 to US$386.1 billion by 2025, at a CAGR of 19.7%. The rapid growth in the volume of data being generated along with the increasing deployment of cloud-based computing platforms is fueling AI adoption across various industry verticals including automotive, transportation, retail, telecom, healthcare, etc.

Axilion is well placed to address the emerging need of smart traffic management systems. The company's X Way Suite combines data analytics (data gathered via AI based cameras), digital twin, and a deep learning AI technology platform, to achieve a highly autonomous and adaptive traffic management system.

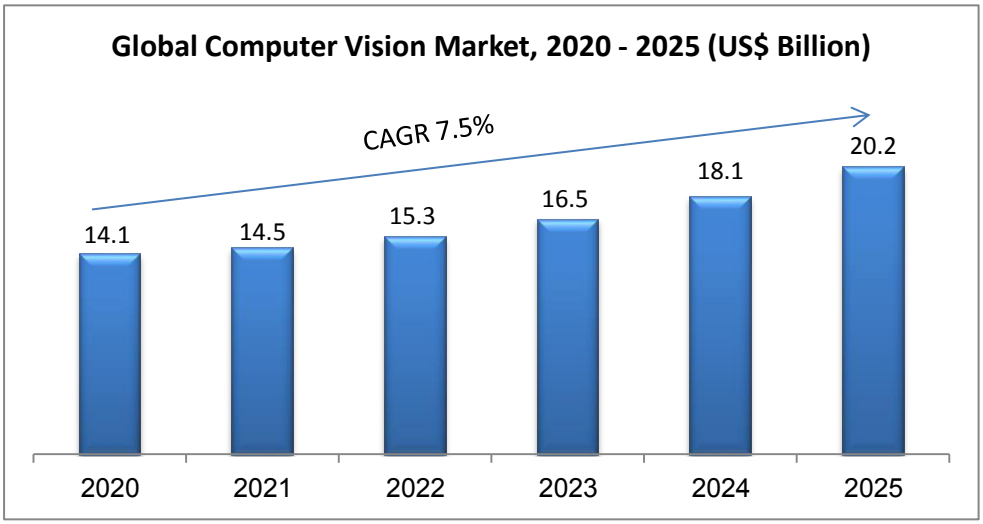
The AI market includes revenue from three technology sub-segments – Software, Hardware, Services. Software is the largest AI technology segment delivering close to 80% of all AI revenue.



Computer Vision:

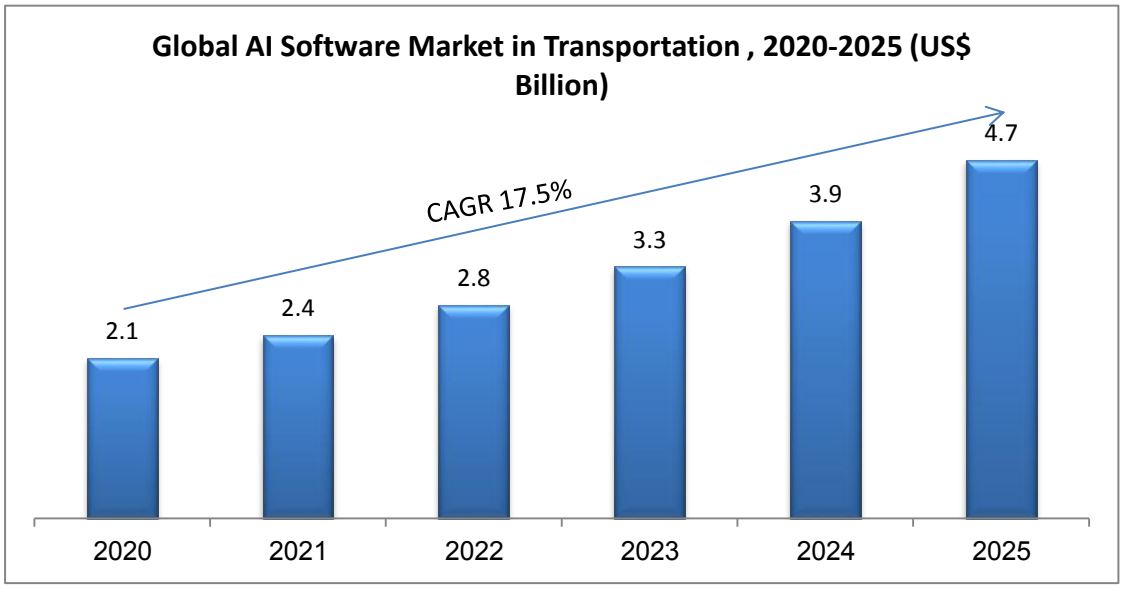
The global computer vision market is expected to grow from US$14.1 billion in 2020 to US$20.2 billion by 2025, at a CAGR of 7.5%. The increasing application of computer vision technology in the automotive and transportation industry is one of the key growth drivers. The emergence of self-driving cars equipped with advanced cameras and LiDAR sensors leverages computer vision to have a safe ride.

Axilion's proprietary dashboard cameras are equipped with GPS and wireless, which enables a real-time data transfer. Through Microsoft azure, Axilion uses its video analysis tool for data collection and analysis for an adaptive and autonomous traffic management system.

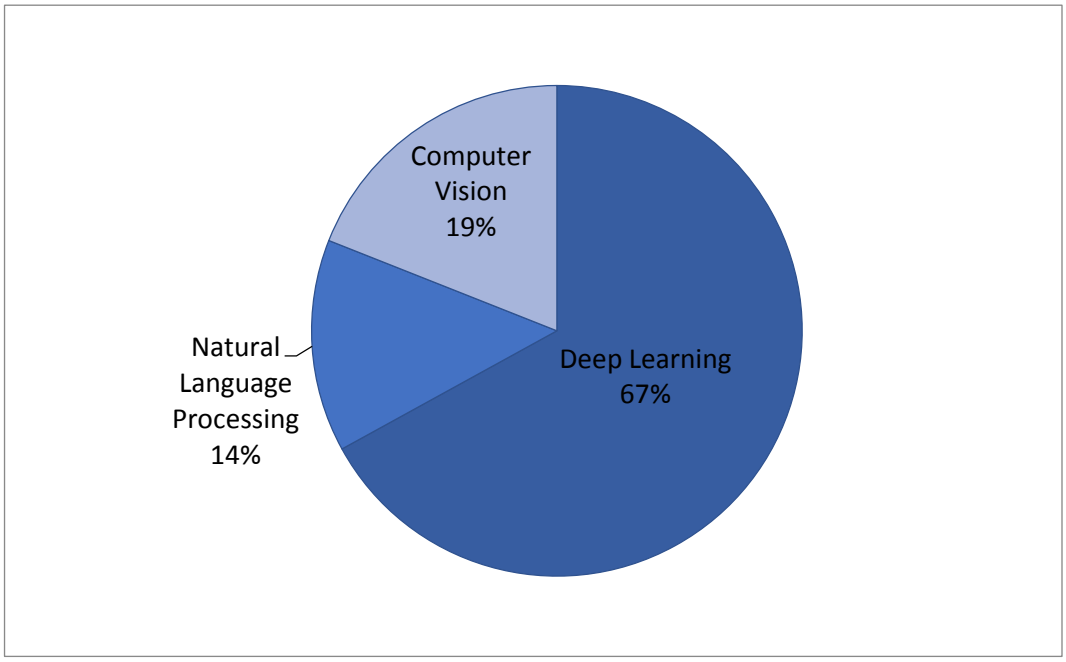


Global AI Software Market in Transportation:

The global AI software market in transportation industry is expected to grow from US$2.1 billion in 2020 to US$4.7 billion by 2025, at a CAGR of 17.5%.



Global AI in Transportation Market by Technology – 2020



Deep learning holds the highest share of around 67% in the global AI transportation market 2020. Deep learning algorithms analyze the hidden patterns effectively in huge volume of data and assist the transportation industry to overcome the traffic issues.

Further, deep learning is a fully automated technique which offers more accuracy when compared with the traditional methods. Computer vision accounts for 19% share of the global AI transportation market and it is primarily used to enable the traffic management system to accurately capture images and analyze them under a wide variety of conditions such as bad weather and lighting, tracking vehicles at high speed and extremely congested traffic jams.

Carbon Capture Needs Has Created a Carbon Market and Technology has Created Market Opportunity

There is a great demand on global markets **to reduce** carbon **emission/carbon capture** solutions. All pathways that limit global warming to 1.5°C project the use of carbon dioxide removal on the order of 100-1000 Gigatons over the 21st century. It is projected that CO2 removal with the right policy support will become the world's biggest market. The climate math propounded by various agencies suggests a need for 10-20 Gt CO2 per year. At an average cost of US$50-100/ton for capture and removal, that creates an industry at least thrice as large as the current size of the Oil and Gas industry.

Tackling the carbon challenge is complex. The world emits an average of 52 Gt CO2e/yr. However, the cost of capturing that carbon is enormous

1. Currently, there are no known solutions to capture carbon at any cost above 38 Gt CO2e/yr
2. The cost of abatement rises quickly at larger volumes to over $1000 Gt CO2e/yr. Whereas, ideally, the cost of carbon abatement should be below $100 per ton to make economic viability
3. The world is already on its way to 80 Gt CO2e/yr
4. None of the carbon technologies currently addresses legacy CO2 removal, which is 95% of the problem.

To achieve the hypothetical net-zero, viz. to remove almost the entirety of 50+ Gt CO2 of annual emissions, the world has to spend at least $85 trillion annually (i.e., ~6% of the world GDP). If the world achieves a sub $50/t cost of carbon capture, the world will still ~2.5% of its GDP but makes the entire process more viable.

As discussed earlier, Axilion's solutions help to reduce carbon emissions significantly. In our view, the company could receive a premium for its services due to its carbon-reducing effect.

Valuation Summary

We based our valuation on a top-down, market benchmark analysis. Observing Axilion market positioning we identified 89 similar companies in terms of activity (AI & ML) and growth stage and excluded outliers from our sample. The average post-money valuation for these similar deals is $453.7M (See appendix 1 of our initiation of coverage report for the full data set). Below we present a sample of the 10 top AI deals:

Company Name	Description	Deal Date	Deal Type	Pre-money Valuation (million, USD)	Post Valuation (million, USD)	Country
Pony.ai	Developer of an autonomous driving technology intended to facilitate manufacturing of automated vehicles.	07-Feb-2021	Later Stage VC	4,933	5,300	United States
C3.ai	C3.ai Inc is an enterprise artificial intelligence company.	09-Dec-2020	IPO	3,375	4,026	United States
Luminar	Luminar Technologies Inc is an autonomous vehicle sensor and software company.	02-Dec-2020	Reverse Merger	2,994	3,400	United States
SentinelOne	Developer of automated cybersecurity software designed to protect devices and servers against malware and threats.	11-Nov-2020	Later Stage VC	2,733	3,000	United States
Verafin	Developer of cloud-based fraud detection and anti-money laundering software.	11-Feb-2021	Merger/ Acquisition		2,750	Canada
Sumo Logic	Sumo Logic Inc is a software company.	17-Sep-2020	IPO	1,846	2,171	United States
Farmer's Business Network	Farmers Business Network is a provider of a farmer-to-farmer agronomic information network.	03-Aug-2020	Later Stage VC	1,600	1,800	United States
Lookout	Developer of cloud-based security software designed to detect mobile threats and improve mobile security.	01-Mar-2020	Later Stage VC	1,701	1,751	United States
Harness	Developer of a delivery-as-a-service platform created to simplify the software delivery process.	06-Jan-2021	Later Stage VC	1,615	1,700	United States
Verkada	Manufacturer of enterprise security cameras designed to offer enterprise physical security services.	29-Jan-2020	Later Stage VC	1,520	1,600	United States

We also view AI and Mobility tech firms since 2020 and found that the median post money valuation is $526.2M, as we present below some of the companies[2]:

Axilion is now after the technological feasibility phase and before the significant sales phase of projects such as those it closed in Haifa and Jerusalem. Therefore, at this stage, we examine the company's value according to similar deals. Based on the aforementioned data and analysis, we estimate Axilion's share price target to be in the range of NIS 15.0 and NIS 16.6, with a mean of NIS 15.8.

About Frost & Sullivan

[2] Source: Pitchbook (showing 38 of 468 companies).

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