Moving AI from Idea to Execution

Smart Cities

POWER OF 2
SOLUTIONS POWERED BY PARTNERSHIP

A Message from Lenovo & NVIDIA

Focused on a bold vision to deliver smarter technology for all, Lenovo is developing world-changing technologies that create a more inclusive, trustworthy, and sustainable digital society. By designing, engineering, and building the world's most complete portfolio of smart devices and infrastructure, we are also leading an Intelligent Transformation – to create better experiences and opportunities for millions of customers around the world.

Accelerating AI relies on GPUs. NVIDIA delivers GPU acceleration everywhere it's needed—to data centers, desktops, laptops, and the world's fastest supercomputers. As companies are increasingly data-driven, the demand for AI technology grows. From speech recognition and recommender systems to medical imaging and improved supply chain management, AI technology is providing enterprises the compute power, tools, and algorithms their teams need to do their life's work.

Analytics and AI are changing the way organizations do business in industries from Manufacturing to Retail, Healthcare to Finance. Nearly half of enterprises have started their AI journey but many are challenged with moving AI from research to reality.

As the Power of 2, Lenovo and NVIDIA unite to bring innovative solutions and intelligent infrastructures used to solve your greatest challenges of today and tomorrow. We equip data-centered researchers, pioneers and visionaries across all industries with the instruments of their life's work and help them to evolve, transform and implement enterprise AI solutions to deliver Smarter Technology for All.

Learn how Lenovo and NVIDIA can help you harness the value of your data and transform your business.

To find out visit www.powerof2.nvidia.lenovo.com.

The Widening World of AI

Global adoption of AI continues to accelerate, moving from initial promise into real-world value for all types of organizations. Omdia, a powerhouse that combines Informa Tech's market leading analyst houses, of Ovum, Heavy Reading, Tractica, and the majority of IHS Markit's Technology research, predicts surging growth and investment through 2021 and beyond, as early adopters deepen investments and fast followers initiate new projects.

In fact, if AI was a country, then its GDP would place in the top #100 in 2020 (between Jordan and Congo). In less than 5 years, that swells to $200bn USD spending and a top #50 berth (between Portugal and Peru). AI is powering a global digital transformation and it's moving fast.

According to the US Bureau of Labor Statistics, the US attained a 5.4% increase in productivity during Q1 2021, the second strongest quarterly growth in the past decade. Omdia believes the real-world deployment of AI technology and the spread of AI beyond hyperscalers is driving new levels of efficiency and productivity. This boost in AI continues to help businesses thrive in a COVID-affected world and AI budgets are only set to increase in the longer term.

To power that growth, AI will reach further down into the ecosystem – including to small and midsized businesses (SMBs) – as it becomes more understood, easier to implement, more scalable and more affordable.

This Omdia eBook, commissioned by Lenovo and NVIDIA, tracks that move from niche to mainstream for AI across all industries – and in particular for the vertical of Smart Cities.

"Now more than ever, knowledge gained from enterprise data and analytics can serve as an actionable antidote to global uncertainty."

Bradley Shimmin, Chief Analyst, AI Platforms, Analytics, and Data Management - Omdia

2020
$45bn
Top #100

2025
$200bn
Top #50

Global AI Spending (Software, Hardware and Data Centre)

Source: Omdia

AI Moves to the Mainstream

AI spending has grown tremendously in recent years – and the global market for AI software alone is expected to increase from $17bn in 2019 to $126bn by 2026. Significant opportunity lies ahead for AI software market penetration, despite short-term economic and market turbulence.

Global AI Software Spending
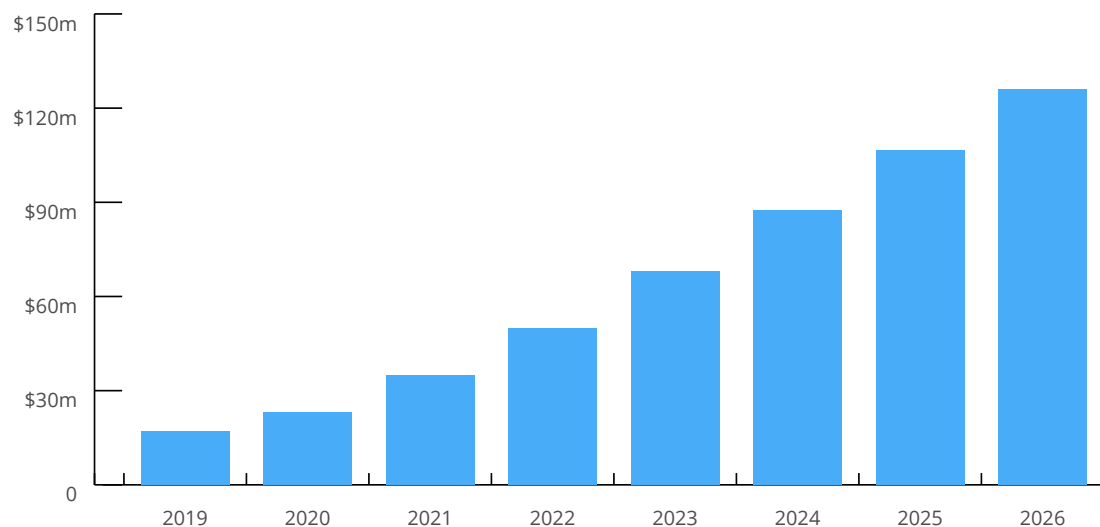
Following a traditional adoption path, many enterprises first pilot the technology with proof-of-concept (PoC) projects, before later moving to full-scale implementation, and often finding AI software can help cut costs and generate

new revenue streams. Yet, AI software remains a relatively small portion of overall software sales, with varying acceptance across industries.

For many, moving beyond the PoC stage has been a significant challenge – but 2020/2021 is proving to be a tipping point in attitudes (especially as COVID accelerates some of the existing trends towards digital and virtual solutions). In an Omdia survey, 24% of enterprises now say they have fully deployed AI in at least one function, as the barrier to entry for what were traditionally highly specialized data and analytics practices has fallen steadily over the past five years.

It's no longer a conversation of how AI 'could' transform businesses, but how it is already doing so. With an increasing number of players involved, the democratization of AI also moves out of the niche and into the mainstream.

24% Enterprises deployed AI in one or more functions

The AI Drivers and Challenges

A mixture of technical and non-technical challenges have held back adoption of AI in many businesses to date – with lack of qualified personnel (the human challenge), complexity (the technical challenge) and lack of budget (the monetary challenge) the top three ranked amongst enterprises.

However, as adoption increases and businesses increasingly see the ROIs proven out from AI solutions and use cases, the business value becomes clearer and businesses are ready for the next wave of projects.
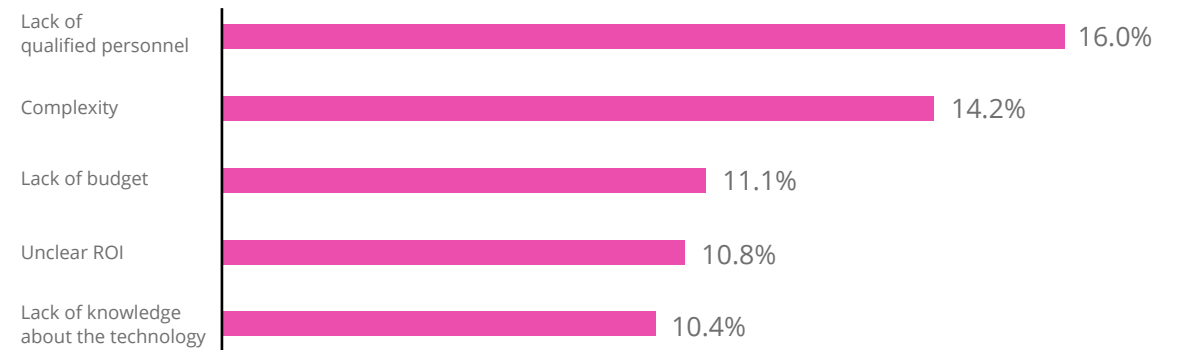
Most encouragingly, the payoff period for AI is also moving closer – a particularly important consideration for the SMB community who can drive the next wave of adoption. In a recent Omdia survey, 72% of small and midsized businesses (SMB, Less than $1bn revenue) respondents said they were confident/very confident AI will deliver positive results towards their business goals within the next 12-24 months. Omdia expects this confidence to translate into surging growth of AI applications in 2021.

The most common AI project KPIs (% of total)

18%
Cost reduction

17%
Engagement

16%
Time reduction

A critical element of this learning is identifying and deploying the best performance metrics. With so much investment at stake and the early-stage nature of AI market adoption, key performance indicators (KPIs) for AI are the most important guardrail for senior management to use to guide their AI strategies. Predictably, the most common KPIs focus on cost reduction, engagement and time reduction.

What is the biggest factor slowing your organisation's adoption of AI?

Factor	Value
Lack of qualified personnel	16.0%
Complexity	14.2%
Lack of budget	11.1%
Unclear ROI	10.8%
Lack of knowledge about the technology	10.4%

Notes: 2020 State of AI Survey (in conjunction with Information Week and ITPro Today; n=288. Source: Omdia

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Breaking Down AI Barriers

Early adopters of AI may gain a competitive advantage, but fast followers can quickly close the gap. In particular, fast followers can game plan potential acceleration of their AI deployment, develop specifications and RFPs to channel AI vendor proposals, learn from the process to choose their vendors/find tools, and move to deployment (and ROI) with ever increasing speed. This is true for both Large Enterprise and SMBs.

As the market grows, the abundance and ubiquity of data coupled with the maturation of self-service analytics has helped companies democratize data among business users and break down data silos between departments. The democratization of AI also extends to the vendor community. For example, where AI hardware used to be the reserve of cloud hyperscalers, AI is now firmly within the broader market for enterprise data centres – with massive potential for AI-enabled servers.

Data center server equipment by market segment worldwide forecast ($)

Most adopted AI professional services (% of total) – Omdia end-user survey

23% Integration services   **21%** Customization services   **20%** Training services

Fast followers can reap the benefit of seeing AI-enabled hardware offered to them in accessible and affordable options, with familiar-looking approaches and solutions. For enterprises and SMBs where the human challenges of knowledge/staff training remains a barrier, buying in ready-made AI expertise and professional services provides a clear and easy adoption path. In fact, vendor expertise is the top reason why enterprises selected a particular commercial AI solution vendor (selected within the top 3 by 79%), with spending on AI professional services split across the spectrum of solution types.

Vendor-led, affordable, accessible and scalable solutions are key in accelerating the AI growth path through the SMB community.
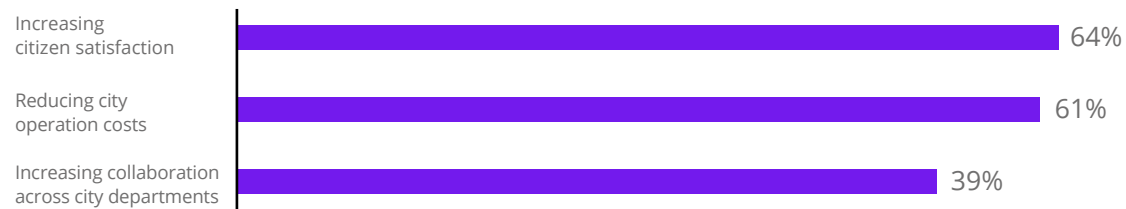
Vertical Market -
Smart Cities

Smart Cities – An Introduction for AI

Over half the global population lives in cities today, and as urban populations grow, cities are becoming more crowded. Traffic congestion, pollution, and increased crime rate are among the common problems that major cities face. To overcome these challenges while also ensuring sustainable growth, many cities have turned to smart city technologies.

Top Smart Cities drivers – Omdia/IoT World Survey

Increasing citizen satisfaction	64%
Reducing city operation costs	61%
Increasing collaboration across city departments	39%

The world of data is ever-expanding, as smart cities harness the huge power of smart devices in addition to other datasets. For example, devices from across sectors such as smart light posts, smart parking devices, connected CCTV and other public security devices, smart urban transport, connected waste management and environmental monitoring, can all be combined to create new and innovative analysis – helping to improve resilience, safety and efficiency.

However, despite the continued growth in connected hardware deployment and corresponding Internet of Things (IoT) connectivity revenue, much of the focus now lies with the software and analytics solutions – enterprises are realizing the value they can unlock from within even existing datasets.

Many smart city projects can be accomplished solely by using IoT technology and data analysis. But AI technology can be a catalyst for allowing enhanced automation, more granular analysis of IoT data, and improved decision-making and control over existing city services and infrastructure. It can also help enable true machine-based decision-making without requiring human intervention, thereby reducing the amount of bias inherent in the human decision-making process.

That's why AI software spend for smart cities will more than quadruple by 2023, while the installed base of smart city hardware devices 'only' increases by 2.5x in the same period.

$17.4bn Smart cities cumulative AI software spend 2020-2026

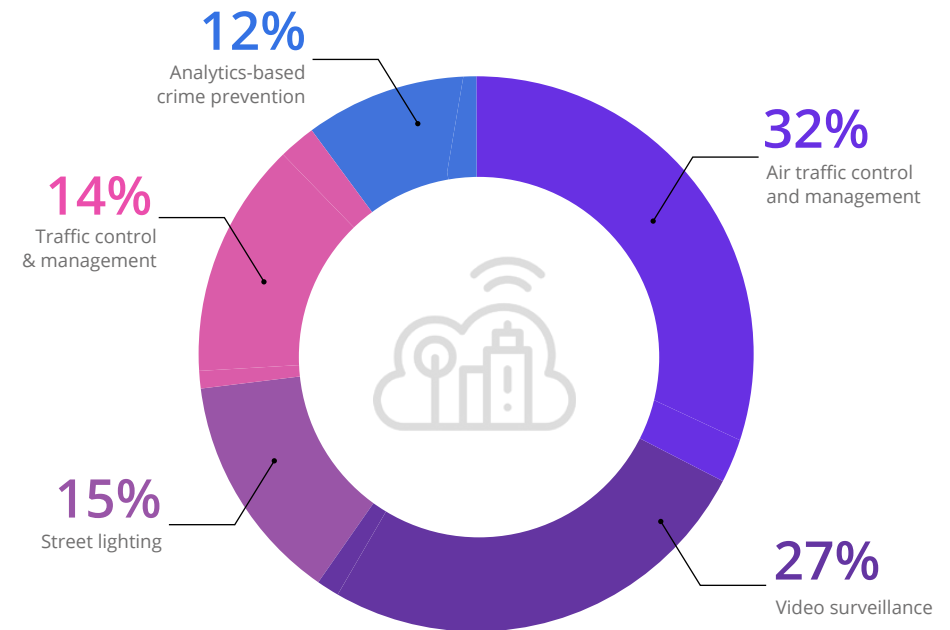# Smart Cities – Applications & Challenges

AI solutions in Smart Cities have the potential to span a wide range of applications, but the leading use cases tend to focus around two common themes: mobility and video surveillance. Unlike many other vertical markets where the solution may apply only to a single building/facility, smart city applications often need to focus on the ability to cover large geographical areas, uncontrolled environments, but with a focus on efficiency and cost reduction. Providing good visibility for monitoring alongside the ability to scale cost effectively is a constant challenge in this space.

Video surveillance continues to be one of the leading use cases within AI software, while it also plays an important role in further applications such as traffic monitoring. A combination of computer vision, machine learning and deep learning can all help facilitate features such as behavior monitoring, people monitoring, device monitoring, and pursue outcomes for safety, security and efficiency.

However, while the value derived from analysis can be large, the cost for communications can be prohibitively high. In particular, advancements in Wi-Fi technology and wireless cellular (4G and 5G) have allowed IoT and consumer wireless services to proliferate – but future applications will increasingly look to provide AI-enabled hardware at the edge, to provide quicker analysis and with less required bandwidth.

In addition to these initial technical challenges, smart city applications also come under scrutiny for cybersecurity, privacy and fairness. Unlike strictly commercial ventures, smart city projects must serve all of the city's citizens and visitors, not just a subsegment of them.

Top five smart city AI software use cases by cumulative revenue, World Markets: 2019-2025

12% Analytics-based crime prevention

32% Air traffic control and management

14% Traffic control & management

15% Street lighting

27% Video surveillance

Source: Omdia

Smart Cities – Case Study

AI-enabled drone video stream analysis at the edge to boost the fight against COVID-19.

In 2020, the global COVID-19 pandemic transformed the world we lived in, with the implementation of social distancing across the globe. In the Italy, the City of Turin went one step further, working with local AI solution provider, Addfor, to help measure the effectiveness of social distancing measures and protect their citizens from the virus.

The Addfor crowdHEDGE solution was connected to drone video streams to analyze and create data-driven insights on behavior in public spaces, such as parks within Turin. Metrics such as foot traffic, crowd sizes, approximate distance between individuals, and frequency of risky social contacts all became visible to city officials, by time and geographical area.

Providing a cost effective but rapid solution for real-time analysis of video footage meant monitoring and processing at the edge. The chosen solution, the Lenovo ThinkSystem S350 edge server, powered by NVIDIA T4 Tensor Core GPUs, was a ruggedized, highly secure edge server that could handle computing, storage and connectivity all at the edge. Analyzing video at the edge (next to video capture) also maintained privacy/security of the footage too.

"Processing and analyzing data at the edge reduces traffic load and improves performance," says Enrico Busto, Founding Partner & CTO at Addfor. "For example, GPU acceleration for analytics workloads enables us to calculate the number of people present in a given area in real time."

As a result, this AI-powered solution helps the City of Turin to make data-driven decisions to protect public health – boosting the fight against COVID-19 in the region and better protecting citizens.

"The use cases developed are related to the real-time analysis of data, which are useful for the development of innovative services for citizens. Thanks to this pilot project in the field of safety and security of public spaces, the City of Turin addresses the combined use of drones, AI, and edge computing to focus on urban and aerospace mobility as an opportunity for the use of AI within the Public Administration."

Marco Pironti – Deputy Mayor Innovation and Smart City, City of Turin

Appendix

About Lenovo

Focused on a bold vision to deliver smarter technology for all, Lenovo is developing world-changing technologies that create a more inclusive, trustworthy, and sustainable digital society. By designing, engineering and building the world's most complete portfolio of smart devices and infrastructure, we are also leading an Intelligent Transformation—to create better experiences and opportunities for millions of customers around the world.

About NVIDIA

In 1999 sparked the growth of the PC gaming market, redefined modern computer graphics, and revolutionized parallel computing. More recently, GPU deep learning ignited modern AI — the next era of computing — with the GPU acting as the brain of computers, robots, and self-driving cars that can perceive and understand the world.

NVIDIA AI

NVIDIA Virtualization (vGPU)

NVIDIA Data Center

About Omdia

Omdia is a global technology research powerhouse, established following the merger of the research division of Informa Tech (Ovum, Heavy Reading, and Tractica) and the acquired IHS Markit technology research portfolio*. We combine the expertise of more than 400 analysts across the entire technology spectrum, covering 150 markets. We publish over 3,000 research reports annually, reaching more than 14,000 subscribers, and cover thousands of technology, media, and telecommunications companies.

Our exhaustive intelligence and deep technology expertise enable us to uncover actionable insights that help our customers connect the dots in today's constantly evolving technology environment and empower them to improve their businesses – today and tomorrow.

* The majority of IHS Markit technology research products and solutions were acquired by Informa in August 2019 and are now part of Omdia.

References/Further Reading

Analysts

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Methodology

The Technology team at Omdia is the leading source of information, insight and analytics in critical areas that shape today's technology ecosystem—from materials and components, to devices and equipment, to end markets and consumers. Businesses and governments in more than 150 countries around the globe rely on the deep market insight we provide from over 300 industry analysts in technology sectors spanning IT, telecom, media, industrial, automotive, electronics, IoT and more. What sets Omdia's AI research Practice apart is our team of technical, experienced analysts, and our end-to-end coverage of the industry.

This eBook pulls together insights from the Omdia AI analyst team, alongside quantitative research highlights from syndicated reports from the Analytics & Data Management Intelligence Service, Artificial Intelligence Applications Intelligence Service, and Artificial Intelligence Business Toolkit Intelligence Service. Some of the key publications within those are listed to the right.

References

- ➡ Artificial Intelligence Software Market Forecasts – 2Q21 Analysis

- ➡ AI Business Performance Metrics Database – 2Q21 Analysis

- ➡ AI Market Maturity Survey

- ➡ AI for Healthcare Applications Report – 2021

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The Omdia team of 400+ analysts and consultants are located across the globe

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