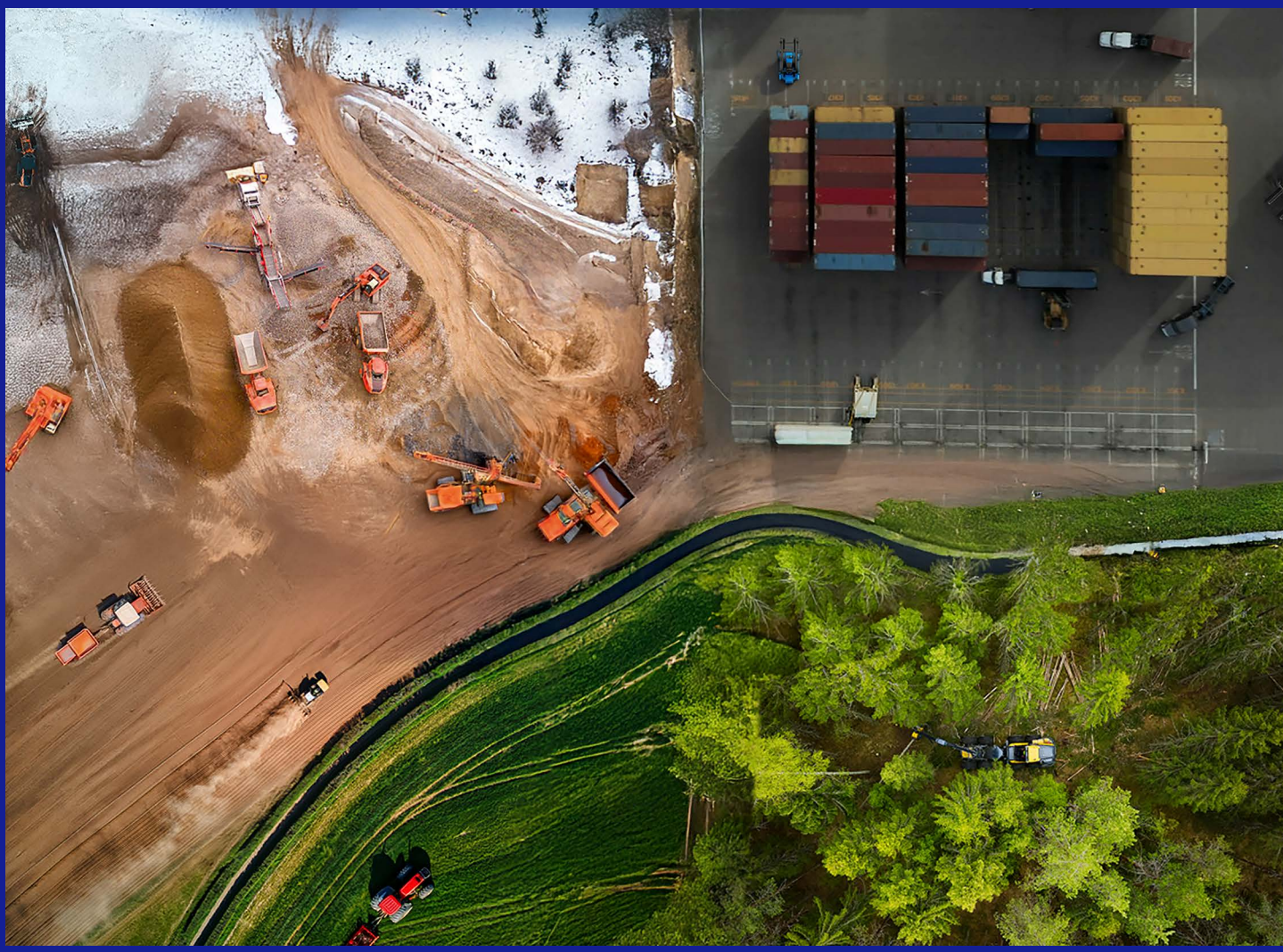


Mighty Machines, Powered by Finland

Finland's National Mobile Machine Growth Strategy 2035

Table of Contents

8/2025

Foreword

In Helsinki, 22.8.2025

As we stand at the forefront of a new era in technological advancement and geopolitical shifts, it is my privilege to present the Finland's National Mobile Machine Growth Strategy 2035 for Finland. This document is not just a blueprint for our future endeavors but a testament to the collective ideas and foresight of a remarkably wide group of individuals and organizations.

First and foremost, I extend my heartfelt gratitude to the SIX Mobile Work Machines cluster and participating companies. Your commitment and expert insights have been the cornerstone of this strategy. To the numerous companies and institutions, both established and emerging, your practical experiences have been invaluable in shaping a realistic and forward-looking approach.

Special thanks are due also to our academic partners from Finland's leading universities, Business Finland, and VTT. Your research and innovative spirit have not only guided our strategy but will also ensure that we continue to foster a culture of continuous learning and adaptation to the changing world.

A special note of appreciation goes to TT foundation, whose generous funding has been a catalyst in turning our vision into a tangible plan. Your belief in the potential of the mobile machine industry in Finland has been a source of encouragement and inspiration.

Equally, I wish to express our sincere thankfulness to Boston Consulting Group for their strategic guidance, insights, and facilitation throughout the development of this report. Your expertise has been pivotal in ensuring that our strategy meets global standards and ambition for growth in the mobile machine industry.

This strategy report is just the beginning. I invite all stakeholders, from industry veterans to aspiring innovators, to join us in the journey of implementing the strategy. Your participation and collaboration are essential in turning these plans into actions that will shape the future of mobile machine industry in Finland and beyond.

Let us move forward together, with a shared vision and concerted effort, to establish Finland as a leader in the global mobile machine industry. The journey ahead is challenging but filled with opportunities. Together, we can create a future that is not only prosperous but also sustainable and inclusive.

With anticipation and optimism,

Minna Helle
CEO, Technology Industries of Finland

This report is an initiative by the Technology Industries of Finland (TIF), made possible with the support of TT Foundation (the Foundation of the Confederation of Finnish Industries and Employers). The authors extend their thanks to the members of TIF, the SIX Mobile Work Machines cluster, and Boston Consulting Group (BCG) for their contributions to the report's development and production. Appreciation is also given to all participants in the survey, one-on-one discussions, and focus group sessions with the SIX Mobile Work Machines cluster, whose insights added significant value to the report. Further sincere thanks are directed to Erkki Ahola, Harri Nieminen, Kalle Einola, Matti Mannonen, Miika Kaski, Pekka Yli-Paunu, Petri Hannukainen, Veli-Mikko Mäkelä, Jukke Malvalehto, Juuso Soininen, Ville Poikolainen, Natan Prajogo, Lauri Hänninen, Julia Vasama, and Leila Helynranta for their important contributions.

About Technology Industries of Finland

Technology Industries of Finland (TIF) is the lobbying organization for technology industry companies. TIF promotes competitiveness and the operational preconditions for technology industry, the largest and most important export sector in Finland. A constantly developing technology industry creates the basis for the long-term prosperity of Finland. TIF has about 1,800 member companies.

Technology Industries of Finland

About SIX Mobile Work Machines

SIX Mobile Work Machines cluster *(hereafter referred to as the "SIX MWM cluster"*, established in December 2020, is an industry-driven cluster that gathers mobile machine OEMs, academia, and technology solution providers under one roof to jointly innovate and further develop the competitive operating environment for mobile machine development. SIX MWM cluster stems from the need to recognize mobile work machine development as a national strength and voicing industry needs towards key stakeholders both nationally and internationally.

SIX Sustainable Industry X | MOBILE WORK MACHINES

Photo: Tapio Haaja, Unsplash

Executive Summary

Finland's **Mobile Machine Growth Strategy 2035** lays out a clear and ambitious vision: Set Finland's mobile machine industry as the global standard for mobile machines and solutions with superior customer value—tripling industry revenue by 2035.

This strategy responds to a pivotal moment in the global mobile machine market. As the sector undergoes a major disruption driven by digitalization, automation, and green transition, the demand is growing for intelligent, low-emission, and service-driven solutions. These shifts are reshaping how machines are designed, operated, and supported.

Today, the mobile machine industry is one of Finland's most critical industrial domains. According to Business Finland, the industry employs 45,000 people, generates €19 billion in revenue, and accounts for over 10% of national goods and services exports[1]. It supports key sectors such as forestry, mining, agriculture, construction, material and cargo handling, and defense.

With a clear strategic direction, the industry is set for substantial growth. By 2035, the strategy targets tripling industry revenue, which indicates approximately 10% annual growth between 2024 and 2035. As a by-product of the growth, the strategy is expected to create up to 45,000 new jobs. To fully materialize the significant growth opportunities, Finland also seeks to remain consistently among global leaders in developing innovative solutions and R&D. These are expected to be achieved through organic growth, market share expansion, and new growth opportunities.

To achieve the vision and targets, the strategy outlines **eight strategic priorities**:

Reach global leadership through excellence in:

- Customer-centric design, service, lifecycle support, and innovative business models
- Strategically selected focus markets through a differentiating offering for known and unmet customer needs
- Smart, data-driven, and AI-powered machines and operations
- Value-accretive solutions that drive sustainability (e.g., electric power system, circularity, customer operations optimization & efficiency)

Strengthen the enablers to support businesses:

- Be the benchmark for integrated, seamless collaboration across the value chain and research-to-product pipeline
- Attractive and predictable operating environment
- World-class talent pool with future-proof skills at scale
- Leader in industry-relevant research enabling the development of specialized and differentiated solutions

Customer value is at the core of this strategy. Future growth will be driven by intelligent technologies and services that increase the total value of ownership: reduce lifecycle costs, improve productivity, and provide more tailored, data-driven support with safety and sustainability at the core of everything. In addition to creating value by improving machines and existing solutions, new innovations will generate totally new value for customers.

This strategy offers Finland a clear path to strengthen its leadership in mobile machine solutions, enhance national resilience, support the green transition, and generate high-quality employment. However, failing to act, especially during the time of ongoing transition, could mean missing out on a major opportunity and gradually weakening a nationally important area of strength.

The strategy was developed through broad collaboration across industry, academia, and financiers, with input from over 200 industry stakeholders. As part of this process, the "Finland Mobile Machine Growth Strategy Survey" was conducted in May 2025, alongside industry interviews and workshops. These insights were key in shaping the final strategy.

[1] Based on Business Finland's definition and collected data on Finland's mobile machine sector. It includes companies directly involved in mobile machines (with more than 70% of their revenue from it) as well as those indirectly supporting the industry through technology or consulting services.

Mighty Machines, Powered by Finland

Finland's National Mobile Machine Growth Strategy 2035

Visio

Set Finland's mobile machine industry as the global standard for mobile machines and solutions with superior customer value

Targets

Triple the industry revenue	Add up to ~45k jobs while improving productivity	Finland recognized as a leading R&D player globally

Strategic priorities

Global leadership position

1 Customer-centric value creation	2 Differentiated, high-impact solutions	3 Smart machines & operations	4 Sustainable solutions at scale
Leader in customer-centric design, service, lifecycle support, and innovative business models	Leader within strategically selected focus markets through differentiating offering for known and unmet customer needs	Leader in smart, automated, data-driven & AI-powered mobile machines and operations	Leader in value-accretive solutions that drive sustainability

Enablers to support businesses

5 Seamless collaboration	6 Pro-business regime	7 Highly skilled workforce	8 Focused primary & applied research
Benchmark for integrated, seamless collaboration across the value chain and research-to-product pipeline	Attractive and predictable operating environment	A world-class talent pool with future-proof skills at scale	Leader in industry-relevant research enabling the development of specialized and differentiated solutions

Mahtikoneet Suomesta

Suomen liikkuvien työkoneiden kansallinen kasvustrategia 2035

Visio

Suomalaiset liikkuvat työkoneet ja niihin liittyvät ratkaisut ovat globaaleja edelläkävijöitä ja tarjoavat ensiluokkaista asiakasarvoa

Tavoitteet

Kolminkertaistaa alan liikevaihto	Luoda ~45 000 työpaikkaa parantaen samalla tuottavuutta	Suomesta alan johtava tutkimus- ja kehitysmaa

Strategiset prioriteetit

Globaali johtoasema

1 Asiakaskeskeinen arvonluonti	2 Erottuvat ja vaikuttavat ratkaisut	3 Älykkäät koneet ja toiminnot	4 Laajavaikutteisesti kestävät ratkaisut
Suunnittelu ja palveluiden kehittäminen perustuvat asiakkaan tarpeisiin	Valituilla markkinoilla tarjotut ratkaisut erottuvat kilpailijoista	Koneet ja palvelut hyödyntävät dataa ja tekoälyä toimien älykkäämmin ja tehokkaammin	Ratkaisut ovat ympäristöystävällisiä ja asiakkaalle kestävää arvoa luovia

Mahdollistajat

5 Saumaton yhteistyö	6 Kasvua tukeva yritysympäristö	7 Huippuosaava työvoima	8 Kohdennettu huippututkimus
Saumaton yhteistyö toimii yli arvoketjun ja tutkimuksesta tuotteeksi putken läpi	Suomi on yrityksille houkutteleva ja ennakoitava paikka toimia	Osaaminen on maailmanluokkaa ja vastaa tulevaisuuden tarpeisiin	Tutkimus kohdistuu oikein ja tukee erikoistuneiden, erottuvien ratkaisujen kehittämistä

Tiivistelmä

Suomen liikkuvien työkoneiden kasvustrategia 2035 asettaa kunnianhimoisen vision: suomalaiset liikkuvat työkoneet ja niihin liittyvät ratkaisut ovat globaaleja edelläkävijöitä ja tarjoavat ensiluokkaista asiakasarvoa – ja ala kolminkertaistaa liikevaihdon vuoteen 2035 mennessä.

Strategia on vastaus liikkuvien työkoneiden toimialan murrokseen. Toimialaa ravistelevat trendit, kuten digitalisaatio, automaatio ja vihreä siirtymä, jotka lisäävät älykkäiden, vähäpäästöisten, ja palvelupohjaisten ratkaisujen kysyntää. Trendit muuttavat tapoja, joilla koneita suunnitellaan, käytetään ja tuetaan. Tulevaisuudessa koneet toimivat yhä enemmän mahdollistavina alustoina uusille palveluille ja ratkaisuille.

Liikkuvien työkoneiden toimiala on yksi Suomen merkittävimmistä teollisuudenaloista. Alan liikevaihto on noin 19 miljardia euroa, se kattaa yli 10 prosenttia Suomen tavara- ja palveluviennistä ja työllistää 45 000 ihmistä. Se tukee myös muita Suomelle keskeisiä toimialoja, kuten metsätaloutta, kaivosteollisuutta, maataloutta, rakennusteollisuutta, materiaalinkäsittelyä sekä puolustusteollisuutta.

Selkeän strategisen suunnan avulla, toimiala on valmiina merkittävään kasvuun. Strategian tavoitteena on kolminkertaistaa alan liikevaihto vuoteen 2035 mennessä, joka vastaa noin 10 prosentin vuosittaista kasvua. Strategian tavoitteena on myös luoda noin 45 000 uutta työpaikkaa ja samalla parantaa työn tuottavuutta. Merkittävien kasvumahdollisuuksien hyödyntämiseksi Suomi pyrkii säilyttämään asemansa maailman kärjessä innovatiivisten ratkaisujen kehittämisessä sekä tutkimus- ja kehitystoiminnassa. Näiden tavoitteiden saavuttaminen edellyttää paitsi orgaanista kasvua, markkinaosuuden laajentamista, myös uusien kasvumahdollisuuksien hyödyntämistä.

Strategia määrittelee **kahdeksan strategista prioriteettia** vision ja tavoitteiden saavuttamiseksi:

Globaali johtoasema:

- Asiakaslähtöisessä suunnittelussa, elinkaaripalveluissa, ja innovatiivisissä liiketoimintamalleissa
- Strategisesti valituilla kohdemarkkinoilla
- Älykkäissä, dataohjautuvissa ja tekoälyä hyödyntävissä laitteissa ja toiminnoissa
- Kestävissä ja arvoa tuottavissa ratkaisuissa, kuten sähköisissä voimansiirtojärjestelmissä, kiertotaloudessa, sekä asiakkaan toimintojen optimoinnissa

Mahdollistajat:

- Saumaton yhteistyö yli arvoketjun ja tutkimuksesta tuotteeksi putken läpi
- Houkutteleva ja ennakoitava toimintaympäristö
- Maailmanluokan ja tulevaisuuden tarpeita vastaava osaaminen
- Hyvin kohdennettu ja soveltava huippututkimus, joka mahdollistaa erikoistuneiden ja erottuvien ratkaisujen kehittämisen

Asiakasarvo on strategian ytimessä. Tulevaisuuden kasvu perustuu teknologioihin ja palveluihin, jotka lisäävät asiakkaiden omistajuuden kokonaisarvoa: ne vähentävät elinkaarikustannuksia, parantavat tuottavuutta ja tarjoavat entistä räätälöidympää, dataan perustuvaa tukea, jossa turvallisuus ja kestävyys ovat kaiken ytimessä. Arvonluonti ei rajoitu pelkästään koneiden ja olemassa olevien ratkaisujen parantamiseen, vaan täysin uudet innovaatiot tulevat luomaan asiakkaille ennennäkemätöntä arvoa sekä uniikkia kilpailuetua toimijoille.

Strategia tarjoaa Suomelle tien vahvistaa asemaansa liikkuvien työkoneiden globaalina edelläkävijänä, parantaa kansallista resilienssiä, tukea vihreää siirtymää ja luoda työllisyyttä. Toimimatta jättäminen merkitsisi suuren mahdollisuuden menettämistä ja ajan myötä kansallisesti tärkeän vahvuusalueen asteittaista heikentymistä. Strategia laadittiin yhteistyössä teollisuuden, tutkimuksen ja rahoittajien kanssa, ja sen valmisteluun osallistui yli 200 alan asiantuntijaa. Työn tueksi toteutettiin toukokuussa 2025 'Finland Mobile Machine Growth Strategy' -kysely sekä joukko haastatteluja ja työpajoja. Näistä kerätyt näkemykset olivat keskeisessä roolissa strategian laatimisessa.

Introduction: Mobile Machines – a Strategic Industry for Finland

This strategy outlines a growth path for Finland's mobile machine industry through 2035. It aims to enhance the industry's global competitiveness by leveraging Finland's industrial strengths and uniting the industry around a shared vision. The strategy presents key growth priorities, targets, and initiatives, building on existing capabilities while seizing new opportunities.

The strategy addresses the mobile machine industry: machines that can move independently and typically operate at high power in demanding environments. The scope of the work includes primarily mobile machines used in agriculture, forestry, construction, mining, and material and cargo handling. It encompasses original equipment manufacturers (OEMs), component and system suppliers, digital solution providers, and research and education institutions. Both Finnish-headquartered firms and multinationals with R&D and/or manufacturing operations in Finland are defined as part of the Finnish mobile machine industry.

Mobile machine industry is one of Finland's most important industrial sectors, employing ~45,000 people and generating approximately €19 billion in annual revenue according to Business Finland[2]. The industry is economically crucial for Finland, accounting for 10–15% of the country's total exports of goods and services. Finland's global reputation in the industry is built on a long history of engineering excellence, developing high-quality solutions and innovations in areas such as automation, electrification, and digital systems. The country's strength is reinforced by strong collaboration across industry, academia, and research institutions. The mobile machine industry not only contributes directly to economic growth but also drives broader innovation and skill development across adjacent industries and sectors such as energy, logistics, and defense.

Finland is a prominent player in the global mobile machine industry, which plays a vital role in domains such as food production, construction, logistics, raw materials, and minerals. The global market for new mobile machines and spare parts is valued at approximately €730 billion in 2024 and is projected to grow at approximately 5% CAGR between 2024 and 2035. All mobile machine sub-sectors are expected to grow steadily through to 2035, with mining and material and cargo handling expected to grow the fastest.

The industry is being reshaped by three powerful forces: macroeconomic shifts (geopolitics, regulation, urbanization, population growth, sustainability), rapid technological advancement (electrification and alternative powertrains, autonomy, AI, connectivity), and evolving business models (equipment-as-a-service, fleet optimization, data-driven support services). These changes are reshaping the competitive landscape and making the industry even more critical in addressing major global challenges such as climate change, urbanization, and labor shortages.

While the industry is experiencing growth, revenue streams are expected to shift significantly—from traditional internal combustion engine (ICE)-related revenue streams towards emerging components, technologies, and services that are driven by electrification and automation. Not all areas are equally profitable, yet many are strategically vital for sustaining long-term competitiveness. Value creation should be assessed through a lifecycle lens, focusing on the total value of ownership: higher productivity, lower lifecycle costs, and safer, more sustainable operations. Mobile machines are evolving into platforms for integrated solutions, and true differentiation comes from understanding customer needs. This shift also enables the generation of new forms of value through data and comprehensive operational insights.

Recent investment patterns show the industry is aligning with global trends. An analysis of approximately 500 investments and M&A transactions between 2020 and 2025 by the largest off-highway manufacturers shows that while most capital (52%) has gone into equipment and distribution, a growing share is being allocated to sustainability (21%) and digitalization (17%)[3].These investments reflect where the industry is headed and what capabilities will define future competitiveness.

This strategy helps Finland build on its strengths and stay ahead in the changing mobile machine industry.

[2] Companies directly involved in mobile machines (<70% of revenues from MM) and those indirectly supporting it through technology or consulting services

[3] Analyzed publicly available investments and M&A transactions (target companies) by the top 100 off-highway equipment manufacturers between 2020 and 2025 to see where they are investing. Three clear clusters emerged: core off-highway industry, digital, and sustainability

Finland's Mobile Machine Growth Strategy 2035

Finland's mobile machine strategy sets a clear direction and ambition for the industry through 2035. The strategy connects global macrotrends with a shared national vision, supported by stakeholder-specific visions. The strategy defines concrete targets, strategic priorities, and practical initiatives to strengthen the industry and its operating environment. Beyond the industry itself, the strategy also highlights broader positive spillovers that support Finland and its industrial competitiveness.

Vision

The vision for Finland's mobile machine industry is clear: **Set the global standard for mobile machines and solutions with superior customer value—tripling industry revenue by 2035.** Achieving this ambition will require active contributions from a broad range of stakeholders, each with a defined, stakeholder-specific vision that aligns with the national goal:

- **OEMs** see Finland as the best place to develop, design, and manufacture world-class mobile machines and solutions—attracted by the predictable business environment, integrated ecosystem, and world-class talent.
- **Upstream network and solution/service providers** benefit from a unique platform for close collaboration with OEMs and public institutions, making Finland the best place to develop, pilot, and scale new offerings.
- **Start-ups and scale-ups** are drawn to Finland's leading innovation ecosystem, offering the best environment to launch and scale new ventures in partnership with established industry players.
- **Customers and operators** value the industry's tech-enabled, user-centric solutions for the unseen value they deliver through increased productivity, lower lifecycle costs, enhanced sustainability, safety, reliability, and more.
- **Workforce,** particularly future talent, sees the mobile machine industry as a growing, attractive, and welcoming sector that offers purposeful, stable employment and opportunities to develop new skills.
- **Research and education** institutions gain global recognition through long-term, high-quality research, attract top talent, and enhance the appeal of their education, while collaborating with industry to ensure innovation and competence development address real-world needs.
- **Financiers** view the Finnish mobile machine industry as a high-potential investment, supported by structured national development programs and a long-term growth outlook.
- **Government and regulatory bodies** recognize the mobile machine industry as a strategic growth sector – combining clear export potential, climate alignment, and national industry resilience.
- **Industry associations** play a unique role in Finland's mobile machine ecosystem, fostering collaboration across companies, accelerating joint innovation, and coordinating stakeholders around shared national objectives.

EXHIBIT 1: SUMMARY OF FINLAND'S MOBILE MACHINE STRATEGY

2035 VISION:

Set Finland's mobile machine industry as the global standard for mobile machines and solutions with superior customer value

- Triple the industry revenue
- Add up to ~45k jobs while improving productivity
- Finland recognized as a leading R&D player globally

Strategic priorities and key initiatives

Global leadership position

Customer-centric value creation	Differentiated, high-impact solutions	Smart machines and operations	Sustainable solutions at scale
Leader in customer-centric design, service, lifecycle support, and innovative business models	Leader within strategically selected focus markets through differentiating offering for known and unmet customer needs	Leader in smart, automated, data-driven & AI-powered mobile machines and operations	Leader in value-accretive solutions that drive sustainability (e.g., electric power system, circularity, customer ops optimization & efficiency)
Initiatives: Deepen integration into customer operations	Strengthen leadership in advanced offering	Utilize data for value-added E2E solutions	Build sustainability into product design
Deliver lifecycle focused solutions	Promote Finland's mobile machine excellence	Develop machine-specific AI and operator integration	Develop next-gen, energy-efficient powertrains
Disrupt service models and expand customer base		Advance autonomy-enabled services & set standards	Embed circularity across the value chain
Ensure best-in-class operator experience		Develop smart connectivity & utilize digital twins	Lead customers towards sustainable end operations

Enablers to support businesses

Seamless collaboration	Pro-business regime	Highly skilled workforce	Focused primary & applied research
Benchmark for integrated, seamless collaboration and research-to-product pipeline	Attractive and predictable operating environment	World-class talent pool with future-proof skills at scale	Leader in industry-relevant research, enabling the development of specialized and differentiating solutions
Initiatives: Develop and expand joint infrastructure	Streamline permitting, regulation, tax processes	Improve structural access to talent	Strengthen university specialization
Create efficient E2E research-product pathway	Incentivize investments in infrastructure	Make the industry attractive for top talent	Enforce strategic long-term research
Strengthen intra-industry collab. & co-innovation	Ensure consistent innovation policy	Aligned education for industry needs	
Strengthen cross-industry collaboration	Support startups throughout full growth journey	Expand training systems for continuous upskilling	
Boost start-up and scale-up collab with incumbents	Promote Finland as a leading hub networks		
Strengthen EU & public-private collab			

Positive spillovers, examples

Industries

Automation & robotics	Data & AI	Battery & energy solutions	Advanced electronics & semiconductors	Engineering & manufacturing services

National capabilities

Sustainability & green transition	National security & tech self-sufficiency	Job creation	Tax income	Strong global reputation

Overall targets

To position Finland as a global leader within the mobile machine industry and home to many leading, world-class mobile machine companies, this strategy defines targets across three priority areas: Revenue and exports; Jobs and talent; and Innovation investments. These targets reflect Finland's ambition to lead in advanced, tech-enabled machine solutions while strengthening its industrial competitiveness and global recognition and presence.

Growth ambition: Triple industry revenue

The Finnish mobile machine industry aims to triple its total revenue from €19 billion by 2035, indicating ~10% annual growth. This represents about 2 percentage points faster growth compared to the industry's growth rate from 2018 to 2023. Finland's mobile machine industry has strong growth potential, supported by increasing demand for advanced solutions in autonomous, electrified, and digital machines, which are the main focus of the Finnish industry. These segments are growing at double-digit rates globally. If Finland meets its targets, its growth will outpace the global average growth rate of ~6% and strengthen its leadership within the field.

Given Finland's relatively small domestic market, long-term growth must come primarily from global markets—a circumstance with which leading Finnish companies are already very comfortable with. Success will also be measured by the number of globally recognized OEMs and system providers based in Finland, as well as stronger performance in international rankings, industry awards, and visibility at major events.

Jobs and talent: Add up to ~45k jobs while improving productivity

Between 2025 and 2035, the industry aims to create up to 45,000 new jobs, adding to the current workforce of ~45,000. Attracting international talent is an important contributor to ensuring a sufficient, competent workforce for Finland's mobile machine industry needs. Particular focus is on attracting those with advanced technical expertise and/or know-how. Non-Finnish students who graduate from Finnish universities and universities of applied sciences are expected to constitute a significant portion of this needed international talent. Finland also aims to become a top destination for seasoned experts and for international students who study elsewhere but are interested in relocating.

Assuming that the industry revenue successfully triples by 2035 but the workforce does not more than double, employee productivity must increase by 50% to 100% during the period. This annual 3–6% revenue per employee growth is driven by a focus on more scalable offerings such as high-value-added machines, new data-driven solutions, increased automation, and modernized production facilities.

Innovation investments: Finland recognized as a leading R&D player globally

To sustain and accelerate innovation and competitiveness stemming from Finland, the strategy outlines the industry's need to increase its R&D expenditure and innovation capacity across the ecosystem—from OEMs to start-ups and research institutions. The industry will track R&D investments using selected key metrics: R&D as a share of revenue and R&D as a share of value added, benchmarked against other countries.

Strategic priorities & initiatives

Meeting these targets will require focused and decisive action across multiple fronts by a range of stakeholders. To achieve the vision of tripling the size of Finland's mobile machine industry by 2035 and positioning the country as the global standard for high-value-added machines and solutions, **the strategy identifies eight strategic priorities** introduced in Exhibit [2].

Four of these priorities focus on securing a global leadership position by developing customer-driven, value-adding offerings that enhance user productivity and improve the customers' total value of ownership—and can also create new, unmet value for the customer. The other four focus on the enablers, which enhance the foundations for sustained value creation and foster seamless collaboration across the value chain. These aim to strengthen the business environment and the industry's capabilities needed to support and scale these solutions sustainably. As illustrated in Exhibit 2: Strategy relational map, these themes are deeply interconnected. Together they form a focused and actionable roadmap to boost innovation, competitiveness, and resilience across the industry.

STRATEGIC PRIORITIES HAVE BEEN DEVELOPED USING THE FOLLOWING LOGIC:

They build on Finland's current strengths and competitive advantages—with an aim to further elevate the already-strong competencies and capabilities towards global standard.

- leverage existing foundation of products, services, solutions from leading companies
- benefit from proximity to customers and the availability of these pilot environments in nearby areas
- enable building "clusters of expertise" to attract investment and maintain and further develop Finland's competitive advantages
- benefit from collaboration between industry players and public organizations (e.g., universities, universities of applied sciences, vocational schools)
- have the potential to leverage Finland's strong startup and innovation ecosystem
- are recognized by the industry players and stakeholders as key opportunity areas— a view that is further validated through the related national mobile machine growth strategy survey

The outcomes of the strategic priorities are linked with a favorable macro environment and strong market demand:

- grounded in solid fundamentals, such as macroeconomic shifts, regulatory landscape and expected evolution (national, regional, global), technological change, and evolving customer expectations
- supported by strong market growth indicators, including market size, growth projections, and profitability potential

EXHIBIT 2: STRATEGY RELATIONAL MAP

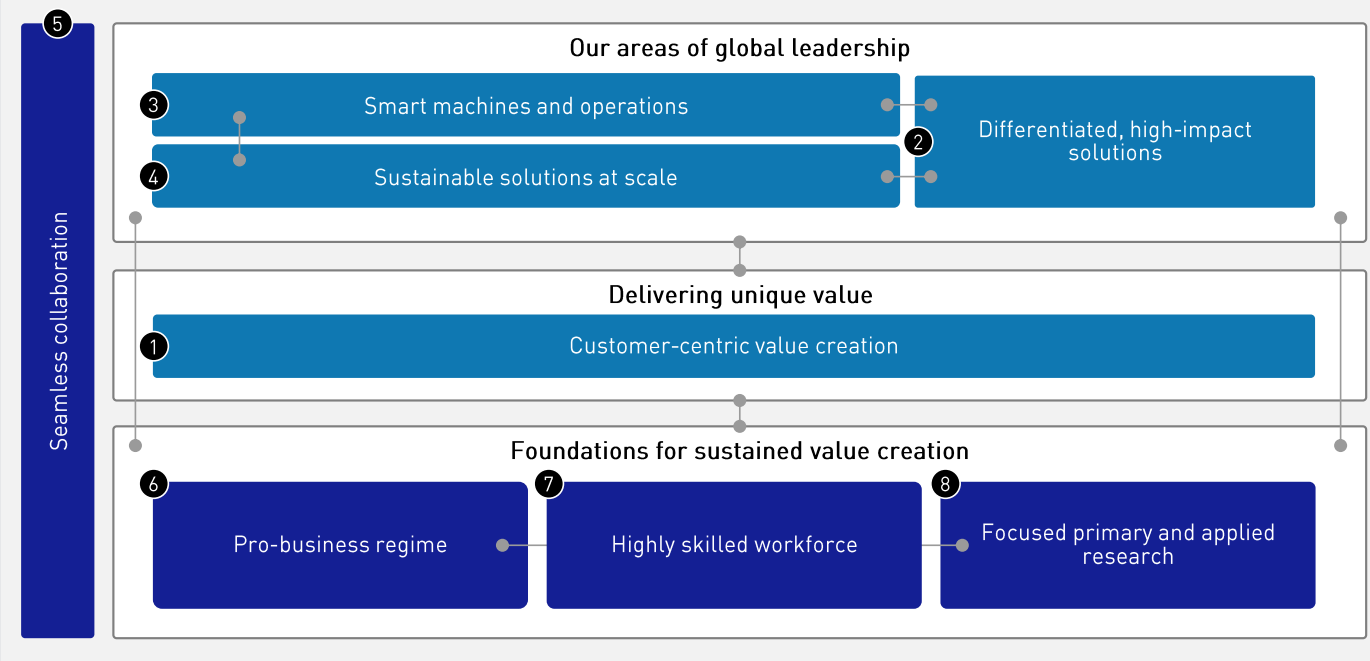


Photo: Ponsse Oyj

1: Customer-centric value creation

Outcome: *Leader in customer-centric design, service, lifecycle support, and innovative business models*

Finland is well positioned to lead in customer-centric value creation by focusing on customer needs throughout the solution lifecycle. This includes designing and delivering machines and solutions that enhance customer productivity, lower lifecycle costs, and align with customer demand while helping customers achieve more sustainable, safer operations. It requires going beyond incremental improvements to lead disruptive innovations that redefine how value is delivered.

The Finnish mobile machine industry already has a strong foundation and reputation for being customer-centric. This is reinforced by the Finnish mobile machine strategy survey conducted for this report, where the industry identified customer centricity as a key strength the industry should build on. Finnish OEMs are known for their agility to adapt to customer needs and for co-developing new products and solutions in close partnerships with end-users. The industry benefits from a highly engaged and sizable domestic customer base across key sectors such as forestry, agriculture, mining, construction, and material and cargo handling, with each offering demanding use cases that support the development, piloting, and refinement of new offerings. In addition, Finland's culture of trust, low hierarchy, and tradition of strong collaboration among stakeholders enable tight feedback loops between OEMs, suppliers, customers, manufacturers, lifecycle services providers, and research[4]. This creates a responsive and adaptable innovation environment.

From good to great: To build on these strengths and to reinforce its position as a leader in customer-centric value creation, Finland will focus on the following key initiatives:

- **Deepen integration into customer operations through co-creation and strategic partnerships.** Scale up customer piloting of OEM equipment in real operating environments (e.g., forests, mines), and move beyond product-centric collaboration to more deeply embed solutions into real-world operational use cases. Involve customers earlier in the development process by using virtual environments to co-develop and validate solutions even before physical prototypes are built. Engage customers commercially in the innovation phase to accelerate time-to-market. Introduce tangible benefit-sharing mechanisms, such as shared R&D costs, technological know-how, and jointly developed solutions. *[responsible: industry, research]*

- **Deliver lifecycle-focused solutions that go beyond equipment to help customers succeed across their entire operations.** Position machines as platforms for integrated, long-term offerings that support the full operational lifespan. Develop intuitive, connected platforms for fleet-wide optimization, predictive maintenance, and sustainability performance, powered by real-time data and deep operational insight. Deploy next-generation diagnostics enabled by intelligent embedded sensors, advanced telematics systems, and smart software tools to maximize machine uptime and enhance overall process efficiency. *[responsible: industry, research]*

- **Disrupt service models and expand customer base.** Offer flexible service options like pay-per-use, uptime guarantees, and tailored support packages. Support customers in adopting new technologies through aligned incentives and business models. Expand offerings to new customer segments emerging from new technologies and services. Explore opportunities beyond traditional mobile machine customers that could benefit from machine-generated data (e.g., government), companies interested in reusing batteries that remain viable after machine use, and organizations developing autonomous or AI models in specialized environments. *[responsible: industry, research]*

- **Ensure a best-in-class operator experience.** Improve machine usability through setting shared design standards and focusing on good ergonomics and clear interfaces—especially important when operators make purchasing decisions. Develop smart operator systems that provide real-time, task-specific guidance to help operators of all skill levels work efficiently and reduce cognitive load, while ensuring that advanced machines remain intuitive and easy to use. Collaborate on remote maintenance models and standardized ways to measure customer and operator satisfaction. Involve operators early via site-based testing, for example, by evaluating novel human-machine interfaces for autonomous equipment. Prioritize operator satisfaction even in automated systems requiring supervision or manual input. *[responsible: industry, research]*

2: Differentiated, high-impact solutions

Outcome: *Leader within strategically selected focus markets through differentiating offering for known and unmet customer needs*

Finland's mobile machine industry aims to strengthen its position as a global leader in selected focus markets by delivering advanced and high-performance offerings. Rather than competing in (low intelligence) mass-market segments, Finnish OEMs focus on specialized product categories where precision, customization, and advanced features that support customers' sustainability goals provide a clear competitive advantage.

Finland already holds a strong global position in several focus markets, including forestry (e.g., cut-to-length forestry solutions), hard rock mining equipment, compact loaders for confined environments, multipurpose utility machines, and material handling equipment used in, e.g. ports. This position is built on a long tradition of engineering excellence, deep customer-driven innovation, a highly skilled workforce, and well-established export channels and networks.

The industry's already strong position gives Finland the "right to win" in specialized, high-value segments of the mobile machine industry. By combining strong co-innovation practices and proximity to highly skilled users, this strategic focus allows Finnish manufacturers to maintain product leadership in various areas.

From good to great: To sustain and expand this leadership in specialized, high-value segments, Finland will advance the following key initiatives:

- **Strengthen leadership in advanced mobile machines by ensuring exceptional reliability, safety, and performance across environments.** Accelerate product development by adopting rapid prototyping and agile R&D methods to deliver specialized, customer-focused solutions. Boost productivity through AI-assisted design, robotics, and design standardization. Jointly develop advanced planning tools by leveraging data, AI, and geospatial technologies to optimize operations in complex and dynamic conditions. Integrate these tools with machine systems and real-time data platforms to reduce downtime, enhance operator efficiency and safety, and ensure consistently high performance across applications. *[responsible: industry, research]*

- **Ensure Finland's strong global reputation in the mobile machine industry continues to grow by actively promoting national strengths in specialized, high-performance machines.** Maintain visibility and reinforce Finland's image as a producer of top-quality, safe, reliable, and productive solutions through clear and consistent branding and marketing. Further differentiate the Finnish offering and build long-term customer preference through joint marketing efforts, a strong presence at international trade events, and storytelling from real-world use cases in demanding environments. *[responsible: industry, associations, research, government]*

[4] A more detailed discussion of Finland's mobile machine market and ecosystem dynamics can be found in the *Finland today: Industry landscape and business environment* chapter

3: Smart machines and operations

Outcome: *Leader in smart, automated, data-driven & AI-powered mobile machines and operations*

Finland is strongly positioned to lead the global transition toward intelligent mobile machines and operations. The focus is on developing data-driven, AI-enabled, and increasingly autonomous machines as platforms that enhance overall customer efficiency, productivity, and safety.

This is supported by Finland's robust technology and innovation landscape. For example, Finland has world-class connectivity expertise through a legacy of telecommunications leadership, which contributions have helped build a deep talent pool of highly skilled engineers, foster a strong culture of innovation, and lay the foundation for the country's digital infrastructure. The mobile machine industry has excellence in developing and deploying advanced software, supported by a vibrant ecosystem of software companies and research partners. In addition, Finland has a broad network of companies and research institutions advancing edge computing, automation, and industrial digitalization. Finland is home to multiple innovation hubs, such as Tampere, Oulu, and the Helsinki metropolitan area, which bring together academia, R&D centers, and industry to co-develop scalable solutions.

Finland also provides an ideal real-world testing ground for smart, data-driven, and AI-powered solutions that support the rapid development and deployment of autonomous mobile machine technologies. This is made possible by its unique combination of strong industrial expertise and advanced digital and connectivity capabilities. In addition, Finland's start-up ecosystem—with international platforms, collaborative innovation alliances, and active venture capital networks—supports tech entrepreneurship and fosters collaboration with established industry players. Together, these position Finland as a frontrunner in delivering intelligent, scalable technologies for next-gen mobile machines. This perspective is echoed in the Finnish Mobile Machine strategy survey conducted for this report, where respondents consistently identified Finland's innovation culture and product excellence as key strengths to build upon going forward.

Photo: ABB Oy

From good to great: To turn this strategic position into sustained technological leadership, Finland will advance the following key initiatives in AI and data-enabled mobile machines:

- **Leverage raw machine and site data by turning it into actionable insights, optimized operations, and value-added services.** Go beyond data collection by first organizing and managing data effectively and securely. Leverage data spaces, standardized formats, and integrated systems such as ERPs to build a foundation for sustainable, scalable, and interoperable services. This foundation enables value-added services such as real-time performance optimization, predictive sustainability reporting, and adaptive fleet maintenance. Support real-time data-sharing through standardized interfaces and open ecosystems to improve cross-site coordination (e.g., sawmills, ports, terminals). Ensure privacy, ownership, and compliance by establishing trusted architectures that protect sensitive operational and environmental data. *[responsible: industry, research]*

- **Develop machine-specific AI and human-machine integration.** Train AI models with task-specific field data (e.g., harvesting patterns, drilling sequences, material flows) and integrate them into machine control software to enable intelligent operator assistance or partial automation. Use onboard systems to collect and annotate training data during regular operations, enhancing model learning with real-world context (e.g., selecting the right tree in a forest). Continuously refine models with real-time feedback to boost performance, safety, and sustainable operations. Partner with AI companies to support data training, model development, and application of AI capabilities in machine operations. *[responsible: industry, research]*

- **Advance autonomous machine operations and set new standards.** Shift from single-machine autonomy to coordinated multi-machine systems guided by centralized fleet and site management tools. Enable plug-and-play setups where new machines self-register and communicate automatically with existing fleet systems. Develop platforms and software systems to dynamically assign tasks, monitor machine activity, and ensure safe collaboration between autonomous units and human operators, while also boosting overall productivity and work quality. Establish thought leadership in autonomous off-highway vehicles by developing shared autonomy level standards and scaling their adoption. Create common user experience (UX) and interface design standards for autonomous machines and fleets. *[responsible: industry, research]*

- **Develop intelligent connectivity and digital twin technologies for predictive, adaptive, and autonomous systems.** Develop and adopt industry-wide data, software, and communication practices (e.g., for sensors, cloud APIs) to ensure plug-and-play interoperability between machines, digital twins, and platforms. Build real-time digital twins by integrating sensor data, control systems, and environmental inputs into dynamic simulation models. Use these twins, for example, in scenario planning, health monitoring, emissions tracking, and failure prediction. Test new functionalities virtually before deployment to accelerate development and improve safety and efficiency. Connect digital twins across the value chain to create a "metaverse" for innovating and testing new products and services. *[responsible: industry, research]*

4: Sustainable solutions at scale

Outcome: *Leader in value-accretive solutions that drive sustainability (e.g., electric power system, circularity, customer ops optimization & efficiency)*

Finland aims to lead in sustainable mobile machines by advancing clean power systems, improving the sustainability of design and manufacturing, integrating circularity, and transforming customer operations to be more sustainable. This includes adopting, developing, and exporting advanced technologies such as battery systems, control software, and circular design practices that set new standards for the global mobile machine industry. Transforming how customers operate can have a greater impact on sustainability than just making more sustainable machines, and mobile machine companies are in a strong position to lead that change.

Finland is internationally recognized for its ambitious sustainability policies, consistently ranking high in global environmental performance assessments[5], with a national strategy that prioritizes environmental responsibility across all sectors of the economy. Finland also benefits from having first-mover customers who are early adopters of sustainable technologies and help accelerate the transformation. Building on this strong foundation, Finland's mobile machine industry is developing sustainable power solutions (such as battery-electric machines, renewable-powered systems), and circular product designs, embedding circularity from the earliest stages of development. Finland's expertise in electrification spans the full system, from batteries and charging infrastructure to integrated digital control platforms, enabling complete and ready-to-use solutions, with research institutions actively contributing to the development of innovation. nland also has robust testing infrastructure for zero-emission solutions, providing a unique R&D environment for energy-efficient, autonomous, and zero-emission work machines. By embedding sustainability and circularity from the design phase, Finnish manufacturers are not only meeting rising regulatory and customer demands but also creating hard-to-match competitive advantages.

From good to great: Key initiatives to establish global leadership in sustainable and electrified mobile machines:

- **Build sustainability into product design, manufacturing, and materials.** Design machines using sustainable, recycled, and low-carbon materials to enable closed-loop systems and prioritize materials with the lowest feasible environmental impact. Make dynamic lifecycle assessment an industry standard and assign digital product identities to track data from material origin to end use. Strengthen collaboration between R&D and manufacturing, within companies and across value chain, to support virtual design and simulation (using digital twins), and the development of new sustainable services. *[responsible: industry, research]*

- **Lead the development of next-generation sustainable powertrains with a focus on energy efficiency.** Drive the shift toward electrified solutions by developing modular drivetrain systems that adapt to different machine types and tasks. Invest in R&D that integrates battery-electric, hydrogen, eFuel, and hybrid technologies with advanced power electronics and smart energy recovery. Design modular powertrain components to meet diverse operational needs and enable flexible system integration across machine types. Expand nationwide, interoperable infrastructure for charging, hydrogen supply, and energy distribution. Introduce incentives to drive early adoption in high-impact sectors like construction, logistics, and forestry. *[responsible: industry, government, research]*

- **Embed circularity across all products and services throughout the value chain by adopting a systemic lifecycle approach.** Design machines for modularity and easy post-production upgrades to extend their usable life, while enabling repair, repurposing, and remanufacturing as standard practices. Establish take-back and reuse systems to efficiently recover value from end-of-life assets, and collaborate across industries to close material loops and enhance recycling flows. *[responsible: industry, research]*

- **Lead customers towards more sustainable operations.** Provide smart services that reduce customers' environmental impact by enabling energy-efficient operation, optimized workflows, and reduced idle time through automation and analytics. Co-develop tailored solutions with clients to address real operational needs and deliver sustainable impact. Offer services to track, report, and improve the sustainability performance of machine fleets. Support customers reach their own sustainability targets, whether carbon, resource efficiency, or ESG goals, through integrated solutions and collaboration. Mitigate soil compaction and negative terrain impacts, especially in sensitive environments, by analyzing and adjusting machine operations (e.g., optimizing soil movement or fertilizer application). *[responsible: industry, research]*

[5] Such as the WEF's Energy Transition Index (ETI) and Yale-Columbia's Environmental Performance Index (EPI).

5: Seamless collaboration

Outcome: *Benchmark for integrated, seamless collaboration across the value chain and research-to-product pipeline—driving accelerated innovation and resilient growth within and beyond the mobile machine industry*

Achieving the outcome means that Finland is positioned as a leader in industrial collaboration, both across private sector companies and between private and public stakeholders. Seamless cooperation throughout the value chain and across the research-to-product pipeline enables faster innovation, shared risk, and stronger resilience. Finland's relatively small size reinforces this agility, supporting a high-trust, low-hierarchy environment that fosters joint development across key stakeholders. This collaborative model strengthens Finland's long-term industrial competitiveness and supports innovation within and beyond the mobile machine industry.

In the private sector, many companies co-develop solutions and maintain deep strategic partnerships across the supply chain. Joint initiatives are also advancing next-generation smart industrial systems that combine connectivity and automation. Public-private collaborations further support this ecosystem. National innovation clusters bring together companies, research institutions, and other stakeholders to accelerate technology adoption, share risk, and boost efficiency. Finland's tradition of close industry–research cooperation is reinforced by targeted programs that align public funding with business and R&D priorities. Agile collaboration, transparent governance, and efficient funding mechanisms enable the transformation of research into practical industrial solutions and support long-term competitiveness.

Finland's right to win is built on a combination of pragmatic industrial partnerships and well-established institutional cooperation. Operating in a small, high-trust environment enables companies to collaborate effectively. At the same time, integrated public-private models link research, funding, and business needs in a coordinated way. Together, these elements foster faster innovation and greater resilience across the entire value chain.

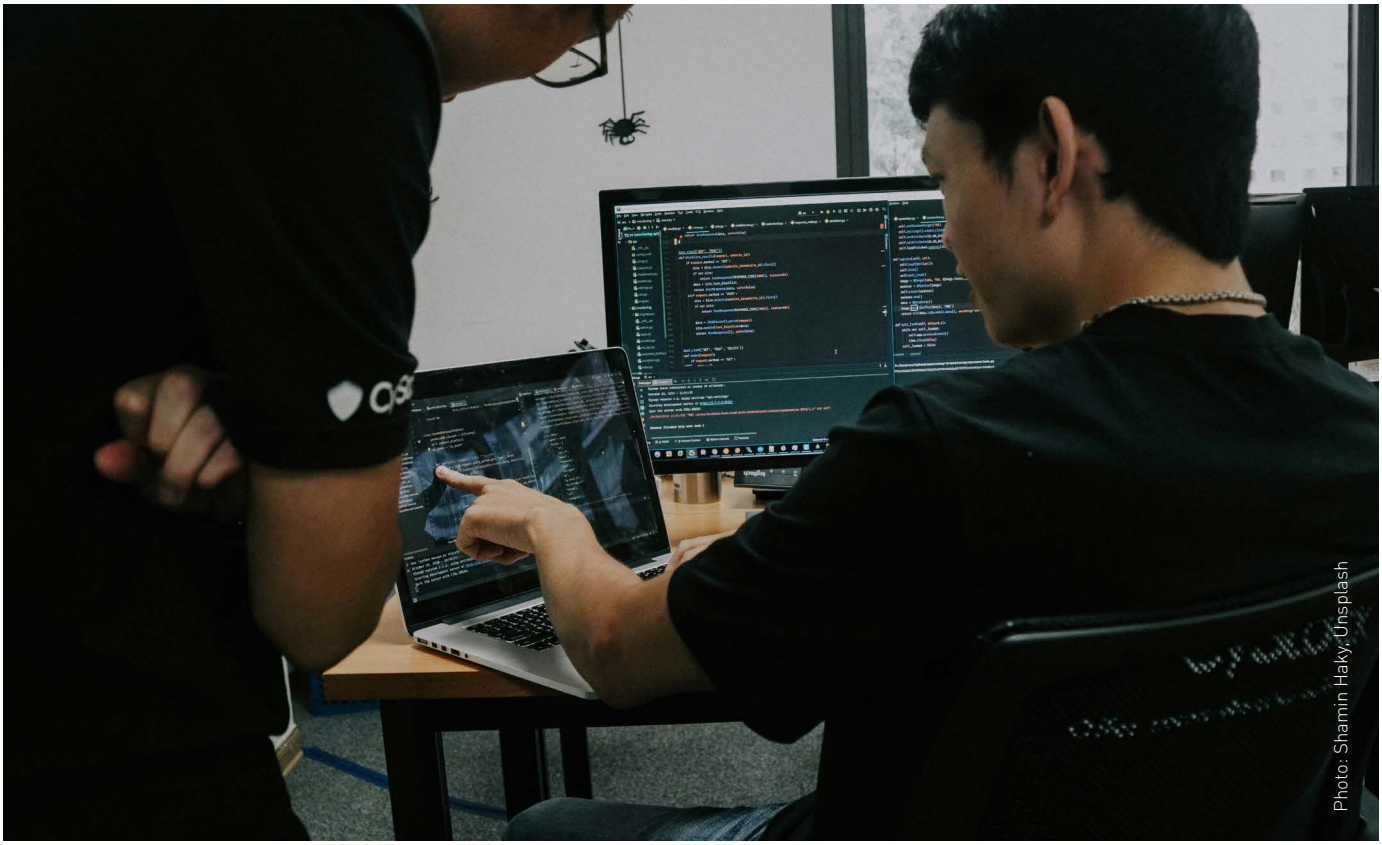


Photo: Shamin Haky, Unsplash

From good to great: While the industry already benefits from strong collaboration and solid foundations, there is clear potential to elevate it further (also confirmed by the industry survey). Key initiatives to enable seamless and next-level collaboration include:

- **Develop and expand joint infrastructure.** Strengthen shared labs, testing environments, and research facilities to foster collaboration, accelerate commercialization, and showcase new solutions. Ensure world-class infra through coordinated development driven by industry-derived research needs, with aligned infra planning integrated into research roadmaps and investments. Increase support to the arctic vehicle testing facilities, and heavy machine labs. Ensure all testing infrastructure is clearly visible, accessible, and collaborative, with clear strengths and mutual support. Set fair pricing and/or provide support so small companies can participate. Explore opening company-owned facilities for broader industry use where feasible. *[Responsible: industry, research, government, associations]*

- **Strengthen research–industry collaboration to create a seamless path from research to product.** Increase industry involvement in the research process and enable joint resourcing through collaboration platforms such as SIX MWM and FIMA, also allowing smaller companies to participate in and benefit from top-level research. Improve researchers' understanding of industry needs by presenting research outcomes in practical, accessible formats using concrete examples, and arranging joint events to enhance transparency and knowledge sharing between research and industry. Expand doctoral-level cooperation (e.g., Intelligent Work Machines Doctoral Programme) to boost technology transfer. Promote closer ties through researcher mobility, joint projects, secondments, and shared spaces near campuses to foster mutual understanding and innovation. *[Responsible: industry, research, associations]*

- **Strengthen intra-industry collaboration and promote co-innovation across the value chain.** Enhance collaboration platforms like SIX MWM cluster to support joint development between OEMs, suppliers, and technology companies. Facilitate co-innovation through shared technology roadmaps, neutral facilitation, and clear IP frameworks. Digitalize supply chain networks by developing industry-wide data sharing frameworks. Promote peer-to-peer collaboration to address common challenges. *[responsible: associations, industry]*

- **Build strategic inter-industry collaboration beyond the mobile machine industry.** Initiate and co-fund joint innovation programs that bring together actors from multiple industries to address common challenges such as electrification, automation, and circularity and to accelerate the scaling of system-level solutions. Strengthen inter-industry 'peer-to-peer collaboration groups' within the SIX MWM cluster (e.g., sustainability, EU task force) and expand it to new areas, such as AI and data. *[responsible: industry, associations]*

- **Boost start-up and scale-up collaboration with incumbents.** Create structured ways to connect start-ups with OEMs, suppliers, and pilot customers. Launch pilot programs, shared testing environments, and early-stage co-development. Simplify entry into the incumbent ecosystem with clear, lightweight proof-of-concept (POC) processes. Launch a flagship event focused on industrial technologies to match start-ups with real industrial needs to accelerate the adoption of new solutions. Engage in startup incubator activities and explore establishing an industry-specific incubator (e.g., through Nordic collaboration). *[responsible: industry]*

- **Strengthen EU engagement and public collaboration to align with industry needs.** Promote larger, more focused R&D collaborations under EU and Nordic programs with industrial priorities guiding research agendas. Increase Finnish participation and leadership in initiatives like Horizon Europe to maximize impact, visibility, and influence over funding calls and program design. Promote a cross-domain mindset in initiatives like Horizon Europe to enable efficient innovation in addressing common challenges across different mobile machine domains. Invest in dedicated resources to support and strengthen EU-level collaboration in the mobile machine industry. Strengthen institutional support for long-term public–private cooperation through clear interfaces between research, funding, and deployment. *[responsible: financiers, industry, associations, research, government]*

EXHIBIT 3: SEAMLESS COLLABORATION

BENCHMARK FOR SEAMLESS COLLABORATION ACROSS THE VALUE CHAIN AND R&D PIPELINE

MORE CUSTOMER PROBLEMS SOLVED

More uncovered and addressed customer needs

FASTER IMPACT

Accelerated absorption from research to products and services

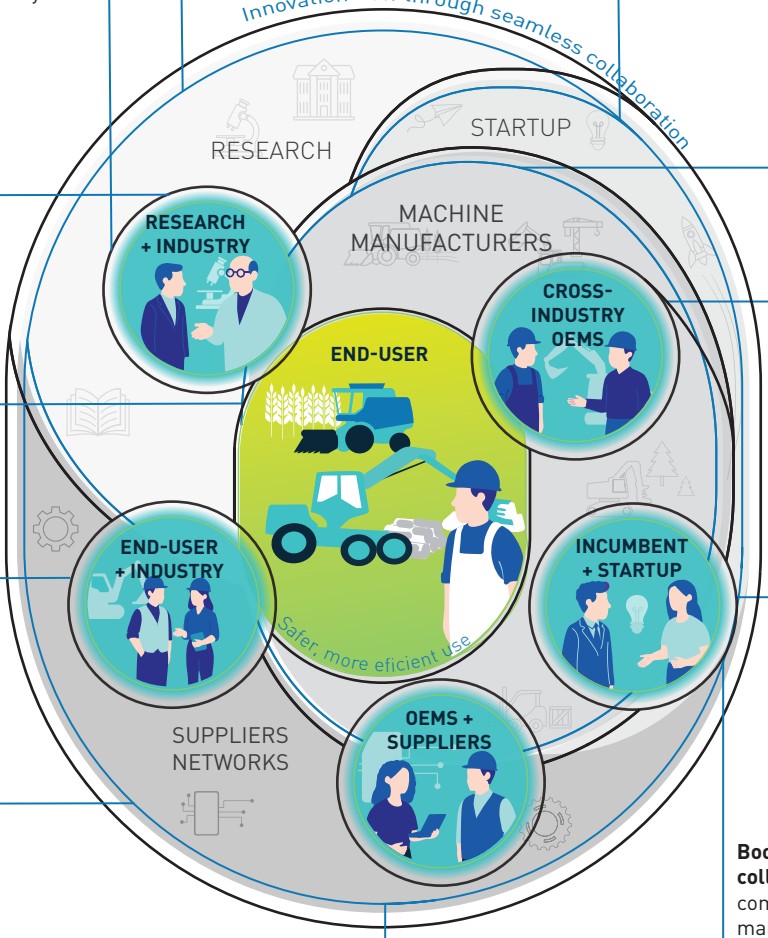
SMARTER USE OF RESOURCES

Targeted resource use on innovations with global winning potential

Universities and industry collaborate to create a clear, efficient end-to-end pathway from research to product, powered by cross-disciplinary work

Universities specialize in their relative strengths and share knowledge, while collaborating with other industry stakeholders to accelerate innovation

Startups and their networks share development methods and collaborate to enable faster prototyping and user-focused innovations



OEMs collaborate across industries to share knowledge and solve common challenges

Develop and expand joint infrastructure by strengthening shared facilities, labs, and testing environments used by research institutions and companies

Strengthen intra-industry collaboration across the value chain and promote co-innovation among established players

End-users and OEMS share testing environments and share feedback to improve design and functionality

End-users and industry work closely together to co-create sustainable solutions that improve safety, productivity, and reduce total cost of ownership

Startups and OEMs partner to co-develop new, innovative data-driven business models such as data-driven sales and sourcing optimization

Component and subsystem suppliers work together on compatibility and integration standards to deliver higher-performing machines and solutions

Boost start-up and scale-up collaboration with incumbents to combine agile approaches with market insights to co-develop data-driven services and accelerate time to market

Software providers and OEMs co-develop real-time digital twins that integrate sensors, software, and machine data for virtual testing, remote monitoring, and feature updates

OEMs and subsystem suppliers combine expertise to build smarter, more efficient, and competitive subsystems by sharing and utilising data

Government enabling a supporting business environment that allows for seamless collaboration across stakeholders

GOVERNMENT AND INTERNATIONAL INDUSTRY STAKEHOLDERS

All stakeholders continuously collaborate with international partners, leveraging global ties to drive innovation and growth

6: Pro-business regime

Outcome: *Attractive and predictable operating environment*

Finland offers one of the most business-friendly environments in the world, providing companies with the conditions they need to invest, grow, and innovate. A stable, efficient, and predictable operating climate supports long-term industrial and economic development.

Finland consistently ranks among the top performers on the global ease-of-doing-business indicators. It offers transparent regulations, strong institutions, and efficient public services. The corporate tax environment has steadily improved over the past decades, and Finland ranks 3rd worldwide in access to clean, affordable energy[6]—factors seen as attractive for industrial operations. In addition, the availability of funding from both domestic and European sources adds another layer of support for R&D-intensive firms. Together, these factors provide a solid foundation for sustained competitiveness.

From good to great: Finland will need to focus on the following key initiatives to ensure a business-friendly environment and to become a globally leading one:

- **Streamline permitting, regulatory, and tax processes to reduce friction for industrial growth.** Digitalize and streamline industrial permitting to speed up factory setups, product testing, and machine deployments. Further develop pre-approved industrial zone programs with standardized environmental and construction permits to reduce lead times for site development. Ensure supportive R&D tax credit structures, for example, by increasing maximum deductible amounts and enabling full and immediate depreciation for industrial investments to accelerate returns. *[responsible: government]*

- **Incentivize investments in future-ready infrastructure to drive innovation and growth.** Support upgrades to outdated production systems and automation through targeted funding (e.g., green transition programs). Ensure access to clean, affordable energy via expanded renewable capacity, modern grid infrastructure, and long-term energy contracts. Invest in AI computing capacity and enhance digital infrastructure, such as 5G, edge computing, and physical assets like test zones, pilot facilities, and logistics hubs. *[responsible: government]*

- **Ensure consistent innovation policy across political terms to support long-term growth.** Promote continuity in regulation, research, education, and funding by advocating for multi-year commitments in strategic R&D areas (e.g., via the Research and Innovation Council) to minimize disruption from changes in government. Increase support for higher Technology Readiness Level (TRL) innovations through grants, loans, and risk-sharing instruments that facilitate international market access. Complement government-backed long- and medium-term projects and funding with shorter-term, fast-track options that feature lighter administrative requirements. Support roadmap-driven, target-oriented activity continuums in innovation development. *[responsible: government, industry]*

- **Strengthen startup and scale-up support across the full growth journey.** Expand early-stage grant programs and introduce late-stage financing tools, such as scale-up loans and industrial deployment funding. Consider tax incentives for production investments by hardware, deep tech, and industrial start-ups. Build stronger links to global startup ecosystems through visiting founder programs and international venture partnerships. Explore new private funding instruments, such as R&D-focused funds or foundation-based models, through targeted studies or pilot initiatives. *[responsible: government, financiers]*

- **Promote Finland as a leading hub for mobile machine companies and their suppliers' networks.** Support regions in organizing company visits, demo events, and site tours. Enable companies to build international visibility through funding and coordinated promotion, while also helping to attract start-ups and small and medium-sized enterprises to Finland. Use national and regional programs to connect Finnish and international companies. *[responsible: industry, government, associations]*

[6] According to World Economic Forum (2024)

7: Highly skilled workforce

Outcome: *A world-class talent pool with future-proof skills at scale, adding around 45,000 jobs while improving productivity*

The achieved outcome means that Finland ensures continued access to a highly skilled, adaptable, and future-ready workforce that supports the growth and competitiveness of the mobile machine sector. A strong talent base is critical for driving innovation, supporting advances in manufacturing, and meeting the demands of increasingly complex and tech-driven markets. Finland's education system is globally respected, with over 40% of the adult population holding tertiary degrees. The country has particularly strong capabilities in engineering and applied sciences, and has professionals known for their technical expertise, productivity, and collaborative working style.

From good to great: Availability of a skilled, adaptable, and future-ready workforce is a cornerstone of Finland's industrial strategy, and key initiatives to ensure that the mobile machine industry has continued access to world-class talent are:

- **Improve structural access to talent by increasing employment flexibility and simplifying foreign recruitment processes.** Align labor regulations to support flexible work and reduce administrative burden in employment practices. Accelerate permits and visas for skilled international workers, streamline residency for foreign graduates and professionals, and explore targeted tax incentives to attract top talent. Make it easier for international talent to stay and change jobs in Finland, for example, by expanding the 3/6-month employment rule. *[responsible: government, industry]*

- **Increase the mobile machine industry's visibility and attractiveness to new talent.** Promote joint talent branding and participate in national and international career and industry events. Strengthen partnerships with universities and vocational schools and raise awareness of mobile machine applications in key fields like electrification, automation, and data. Highlight non-traditional career paths to attract diverse skill sets. Improve foreign talent recruitment by simplifying hiring processes, increasing relocation support, and fostering multilingual workplaces. Promote gender diversity to build a more inclusive and balanced workforce. *[responsible: industry, associations, research]*

- **Align education curricula with industry needs and strengthen academia–industry collaboration.** Deepen cooperation between industry and universities, universities of applied sciences, and vocational education to ensure degree programs reflect emerging technologies and skills required in the mobile machine industry. Integrate doctoral training paths into industry collaboration models. Ensure a strong talent pipeline in key fields like manufacturing, electronics, and electrical engineering through high-quality programs with sufficient capacity. Involve companies in curriculum development, guest lecturing, and project-based courses to better connect education with real-world applications. Expand thesis and internship opportunities for international students and encourage especially SMEs to leverage master's thesis projects more. *[responsible: research, industry]*

- **Expand training systems to ensure continuous upskilling and workforce adaptability.** Develop government-backed and -orchestrated upskilling programs that are delivered through Finland's broad network of universities, universities of applied sciences, and vocational schools. Companies should support employee learning by enabling participation in flexible, work-integrated education. Program costs can be shared through participant fees paid by the benefiting parties. Include targeted programs for doctoral-level professionals to support lifelong learning and bridge knowledge gaps between research and practice. *[responsible: research, government, industry]*

8: Focused primary and applied research

Outcome: *Leader in industry-relevant research enabling the development of specialized and differentiated solutions*

Achieving this means that Finland leads in aligning research with industrial needs, enabling scientific knowledge to be translated into practical, high-value solutions for mobile machines. Both fundamental and applied research play a central role in driving innovation and strengthening long-term competitiveness.

Research is a strategic asset for Finland's mobile machine industry. Finland boasts a wide and distributed network of academic institutions, including 13 universities and 22 universities of applied sciences. These institutions are actively engaged with industry and have a strong track record in producing research that leads to commercialization. The country also ranks highly in R&D spending relative to GDP and attracts top-tier scientific talent.

Finland's ability to connect academic excellence with industrial applications gives it a clear advantage. Strong collaboration between research institutions and companies enables progress in key areas such as automation, digitalization, materials science, and sustainable engineering—fields that are critical for future competitiveness.

From good to great: Key initiatives to lead in targeted, high-impact research:

- **Strengthening research excellence through university specialization and focus on fewer but deeper areas.** Encourage universities to focus on fewer, well-defined (mobile machine) areas such as digital twins, multibody dynamics, or green technologies to build deep expertise and maximize industrial impact. Clearly communicate each university's research focus and role to improve visibility and collaboration with industry. Foster deeper partnerships through shared research facilities and real-world projects to enhance relevance, accelerate impact, and expose students to practical industry challenges. Strengthen doctoral education to ensure a steady pipeline of highly skilled experts who not only excel in research but also understand real-world industry needs. *[responsible: research, government]*

- **Enforce long-term research strategies and funding models beyond short project cycles.** Create multi-year research platforms co-funded by industry and government, with continuity built into the university project portfolio. Build long-term, interdisciplinary teams, not just project-based groups, to ensure competence retention and deeper system-level thinking. Incentivize universities to involve companies in research projects and to integrate doctoral education as a strategic tool for long-term competence building. *[responsible: research, government]*

Positive spillovers

In addition to its direct economic contributions, Finland's mobile machine industry creates substantial spillover effects that benefit a wide range of other industries and strengthen the national economy and resilience.

The mobile machine industry drives demand for adjacent technologies and services, creating positive spillovers **for multiple domains and industries**, for example, in the following areas (non-comprehensive list):

- Automation & robotics: Advances in autonomous mobile machines accelerate innovation in robotics, control systems, and machine learning, with cross-sector applications, such as in logistics, mining, agriculture, and maritime operations.
- Data & AI: Data is collected, analyzed, and integrated from specific operating environments, forming the foundation for broader data ecosystems beyond mobile machines. This domain-specific data supports the development of software solutions, advanced analytics, and AI models, enabling targeted use cases across sectors such as construction, smart infrastructure, and precision agriculture.
- Battery & energy solutions: The push for electrification fuels innovation in battery technologies and charging infrastructure, which can be transferred to other applications including industrial equipment and grid-scale energy storage.
- Advanced electronics & semiconductors: Increasing digitalization and sensor integration in mobile machines stimulate progress in chip design, embedded systems, and signal processing.
- Engineering & manufacturing services: The industry creates demand for specialized components, precision manufacturing, and software integration, providing growth opportunities for high-tech SMEs.

Beyond industrial impact, the mobile machine industry strengthens **Finland's broader national capabilities and economic foundation** (includes examples, not all inclusive):

- Sustainability and green transition: resource-efficient systems, electric drivetrains, and smart control solutions developed directly support Finland's wider climate goals and decarbonization targets.
- National security & technological self-sufficiency: the development of dual-use machines serving both civil and defense needs supports national preparedness and reinforces societal resilience. Building domestic expertise in key areas such as power electronics, control systems, and manufacturing reduces dependency on foreign supply chains and enhances national resilience.
- Job creation: the mobile machine industry generates high-quality jobs across Finland, supporting regional employment and strengthening the national talent base.
- Tax income: As a large and fast-growing industry, it contributes significantly to public finances through increased tax revenue, helping to fund public services, infrastructure, and innovation.
- Strong global reputation: Finland's strengths in the mobile machine industry attract international partners and boost its image as a high-quality, trusted technology leader. This helps position Finland as a premium brand in the global industrial market.

Conclusion

Building on its strengths, Finland is uniquely positioned to set the global standard for mobile machines and solutions that deliver superior customer value. The Mobile Machine Growth Strategy 2035 lays the foundation for tripling industry revenue, creating tens of thousands of jobs, and driving sustainable innovation in Finland. Turning this ambition into lasting competitiveness and global impact will require active efforts across the eight strategic priorities. The strategy outlined in the report is just a starting point—strong collaboration among stakeholders and decisive action will be key.

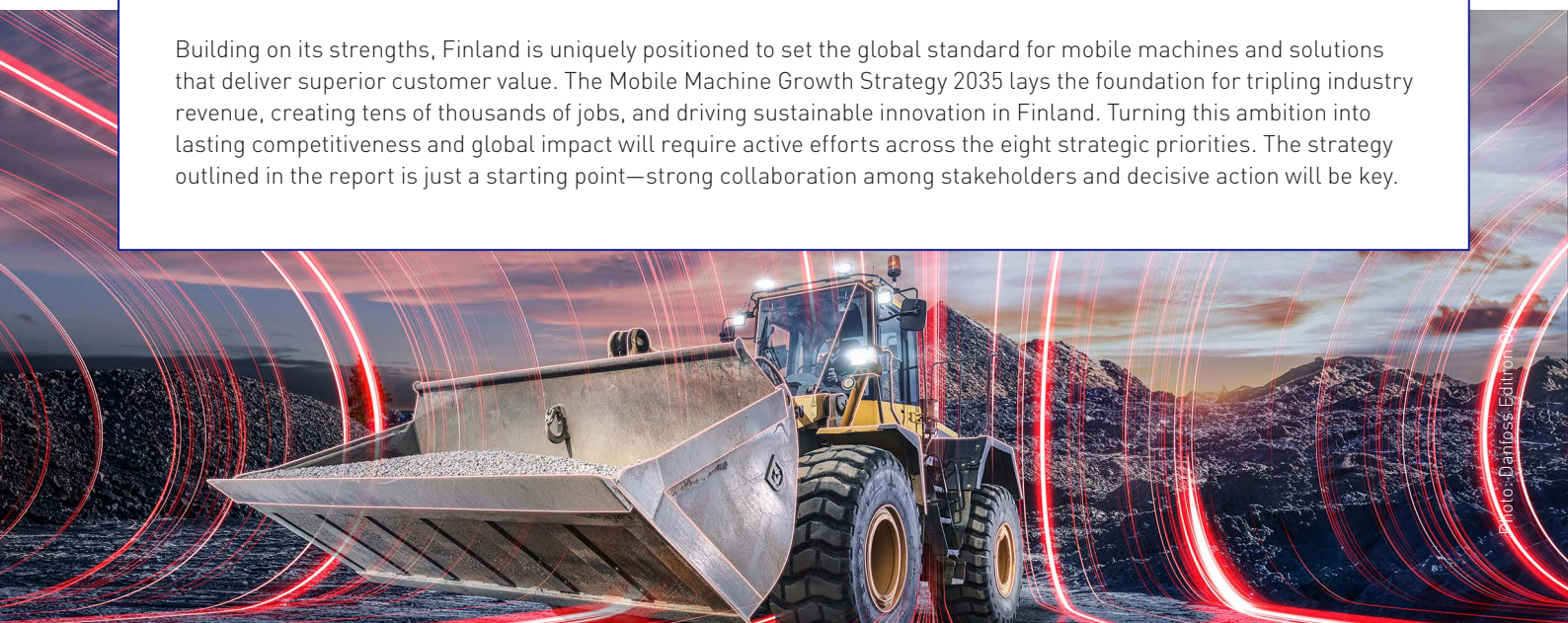


Photo: IONCOR Oy

Finland Today:
Industry Landscape
& Business Environment

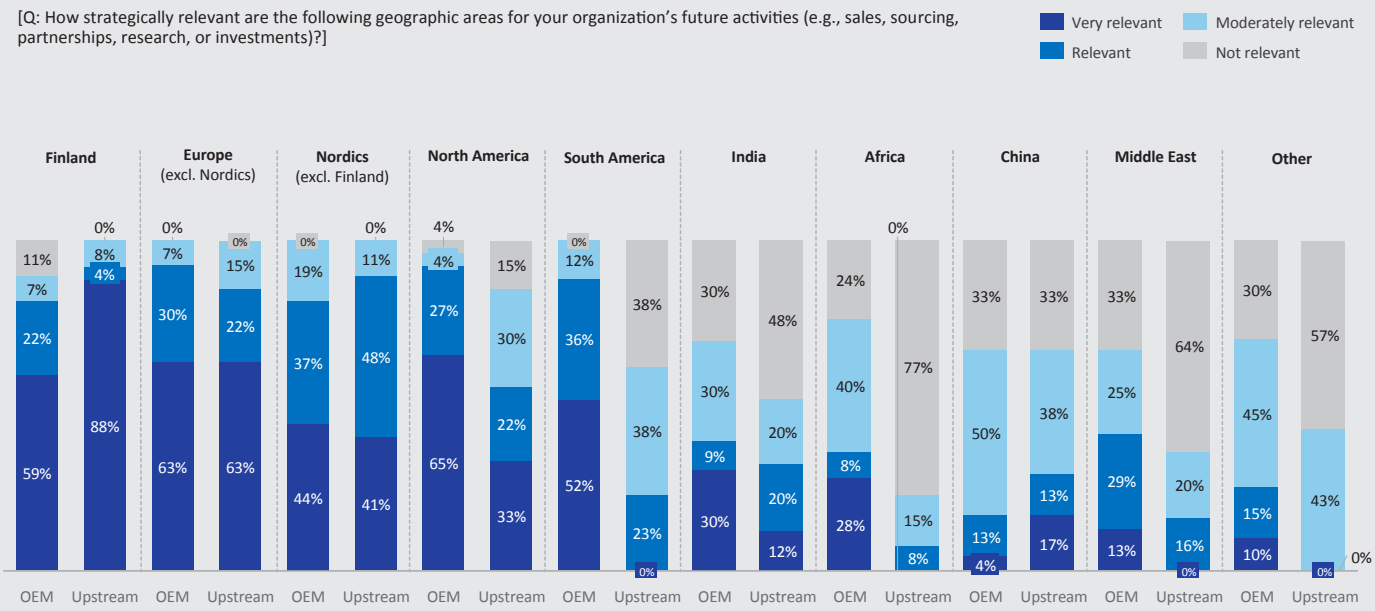
Industry overview

As one of the key export sectors, the mobile machine industry is a significant contributor to Finland's economy. According to Business Finland, it generates an estimated €19 billion in annual revenue, exports over 70% of its production (more than 10% of Finland's total exports of goods and services), and employs about 45,000 people[7]. These figures include companies for whom the mobile machines are their main business (defined as >70% of revenue directly from mobile machines) as well as those that support it through, e.g., software, technology, components, contract manufacturing, or consulting services. Finland is known for delivering premium mobile machine solutions, built on a strong engineering background and innovation leadership in areas like electrification and automation.

While there is a sizeable domestic market in Finland across all mobile machine sectors, all major Finnish OEMs also operate internationally, serving global and regional markets. According to the industry survey conducted for this report, Finnish mobile machine companies have somewhat varying views on the strategic importance of different regions. As shown in Exhibit 5, North America and Europe are considered the most strategically important by OEMs: 65% and 63%, respectively, rate them as highly relevant. In contrast, upstream suppliers (subsystem, component, tech providers) place greater strategic emphasis on Finland and the Nordic region than OEMs. China is not regarded as a top strategic geographic priority for many.

[7] Based on Business Finland's definition and collected data on Finland's mobile machine industry. It includes companies directly involved in mobile machines (with more than 70% of their revenue from it) as well as those indirectly supporting the industry through technology or consulting services.

EXHIBIT 4: FUTURE RELEVANCE OF GEOGRAPHIES FOR FINNISH MOBILE MACHINE COMPANIES



The main segments of Finland's mobile machine industry include mining, material and cargo handling, forestry, construction, and agriculture. Additionally, many of the technologies developed for these segments, such as autonomy, electrification, and smart control systems, have beneficial spillover effects and dual-use applications in areas like defense, marine, and security, further enhancing Finland's broader industrial competitiveness.

As shown in Exhibit 6, Finland has a diverse set of mobile machine players operating across the value chain, including OEMs, upstream technology providers, and service operators. The upstream suppliers operating in Finland excel in hydraulics, drivetrain technologies, and machine control systems, underpinned by a long tradition of R&D and manufacturing excellence. Companies like Norrhydro, Hydroline, Novatron, EPEC, Dynaset, and AGCO Power provide essential components such as hydraulic cylinders, engine systems, and control electronics, tailored for demanding applications in mining, forestry, and port logistics. Finnish suppliers offer deep specialization in hydraulic systems, including manifolds, pumps, valves, and hoses, and in drivetrain components like transmissions, axles, and electric drivetrains. Finland's high-tech machine control systems manufacturers are global leaders and drive innovation and develop advanced technologies that extend across mobile machine segments.

Mining is the largest segment of the Finnish mobile machine industry, with ~40% share of the total industry revenue[8]. Finland acts as a hub for hard rock mining solutions, with Sandvik operating its center of excellence for underground drilling rigs and loaders, supported by an on-site test mine. Finnish engineering has played a central role in the development of advanced automation systems. Normet is another major player in the sector, renowned for providing tunneling and underground transport equipment. Metso, though not only a mobile machine manufacturer, supports the industry with mineral processing equipment, digital solutions, and services that complement mobile operations.

Material and cargo handling is another large segment, comprising ~30% of the industry revenue. Finnish-based firms lead innovation in port logistics and terminal automation, including the likes of Kalmar, Konecranes, Mantsinen, and Mitsubishi Logisnext (Rocla). Kalmar is a global pioneer in terminal automation and hybrid equipment, with a significant installed base of automated stacking cranes and shuttle carriers in major ports worldwide. Konecranes develops container handling equipment with a strong emphasis on automation, connectivity, and predictive maintenance. Mantsinen focuses on material handlers for port and industrial operations, while Mitsubishi Logisnext (Rocla) supplies automated guided vehicles (AGVs) and electric warehouse forklifts.

[8] Segment shares are based on OEM revenue figures for 2023. Percentages calculated by summing OEM revenues across all segments and determining each segment's proportion of the total.

EXHIBIT 5: EXAMPLE COMPANIES OPERATING IN FINLAND ACROSS THE MOBILE MACHINE INDUSTRY

Non-exhaustive list

	Upstream network: Structure, implement, traction + powertrain power source layer				Upstream network: Control and information		Mobile Machine OEMs				Operations services	
Agriculture	Bucher Hydraulics	Hydraulics	Bevenic	Electronics	Technion	Control systems	Sampo Rosenlew	Harvesters	Valtra	Tractors	Mtech	Farm software
	Black Bruin	Hydraulic motors	Fortaco	Structures	Wapice	IoT	Norcar	Loaders	elho	Mowers	Soil Scout	Soil sensors
	Time	Seed drills	Suokone	Mulchers			Ala-Talkkari	Trailers	Junkkari	Seeders		
		Frames	AGCO Power	Engines								
Forestry	Nokian Tyres	Tires	Waratah	Harvester heads	Trimble Forestry	Mapping tools	Ponsse	Harvesters	Toijala Works	Log stackers	Collective Crunch	Forest analytics
	Nordic Traction	Tracks	Mesera	Cranes	EPEC	Control systems	John Deere	Harvesters	Kesla	Cranes	Treemetrics	Forest analytics
	Hydroline	Cylinders	Nisula	Harvester heads			Prosilva	Harvesters	Sampo Rosenlew	Harvesters		
							Logset	Forestry machines				
Construction	Miilux Oy	Wear parts	ABB	Automation	Unikie	Autonomy	Avant	Loaders	Wille	Multi-purpose machines	Infrakit	Site mgmt.
	pmc hydraulics	Hydraulics	MSK	Cabins	Tamtron	Weighing	Bronto Skylift	Aerial platforms	LMCE Group	Loaders	Ramo	Equipment rental
	Fortaco	Structures	Proventia	Emissions systems	Novatron	Machine control	Junttan	Piling rigs	Dinolift	Areal lifts	Aifor RTT	Site automation
	Ioncor	Batteries	Allu	Screener crushers	Oinride	Robotics						
Mining	Gardner Denver	Compressors	Sandvik	Transport systems	Comatec	Engineering	Sandvik	Mining equipment	Sisu	Trucks	E. Hartikainen Oy	Mining contracting
	Robit	Drill bits	Katsa	Gear units	Arnon	Electrification			Epiroc	Drilling		
	Hydac	Filtration	Dynaset	Hydraulic equipment	IMA	Ore sorting	normet	Underground machinery	Metso	Crushers	Tapojärvi	Mining contracting
	Mincon	Rock tools										
Material / cargo handling	Hydoring	Cylinders	Parker	Hydraulics	eteplan	Engineering services	Kalmar	Cargo handling	Mantsinen	Material handlers	Steveco	Port ops
	Satel	Radio modems	Norr Hydro	Hydraulics	Exertus	Control systems	Konecranes	Lifting equipment	tana	Waste machines	Cargoson	Logistic mgmt. software
	Danfoss	Electric drives			Tuxera	Data solutions	Rocla	Forklifts	Meclift	Forklifts		
					GIM	Autonomy						
					Siemens	Autonomy						

Forestry is a hallmark of Finnish excellence and accounts for ~15% of the industry revenue in Finland. Finnish forestry machines are highly specialized, which helps defend Finland's strong market position against new entrants. Finland is at the forefront of advancing rubber-wheeled cut-to-length (CTL) forestry solutions, setting a global example in promoting more sustainable and biodiversity-friendly forest management. While many regions around the world still rely on the full-tree method, it is gradually being replaced by CTL systems pioneered and widely adopted in Finland. Ponsse's Scorpion series CTL harvesters are among the most advanced forestry solutions in the world, recognized for operator ergonomics and data-driven forest management, whereas John Deere's facility in Joensuu serves as a global hub for CTL machines, producing forwarders and harvesters for worldwide markets. In addition, companies such as Logset and ProSilva also export high-performance forestry machines, making Finland a key player in the global sustainable forest operations. Finland's competitive strengths within the forestry sector have been built over time: the country has a long history in the forestry business and has built deep expertise across the forest value chain, shaped by globally influential forestry companies like UPM, Stora Enso, and Metsä Group, all of which focus on a wide range of sustainable forest products.

Construction machines constitute approximately 5% of Finland's mobile machine industry revenue and include export-driven focus domains within which Finnish firms maintain strong positions. For example, Junttan is a global leader in reliable hydraulic pile-driving rigs for challenging geotechnical conditions, whereas Avant Tecno specializes in compact loaders with over 200 attachments for versatile landscaping and property maintenance. To add to that, Bronto Skylift specializes in aerial platforms, widely used in industrial firefighting and high-reach applications globally.

Agriculture, though smaller in scale at under 5% of industry revenue, is characterized by strong technological specialization and a strong R&D focus. Finland's agricultural machine sector benefits from solid domestic demand, and the market is driven by both local companies and subsidiaries of major global players like AGCO. Valtra, part of the AGCO Group, offers highly customizable tractors adapted to northern climates and diverse farming conditions—technological flexibility that supports a strong global export business. Seasonal variation and harsh winters have fostered a unique emphasis on machine versatility in Finland, where equipment is routinely adapted for multiple uses such as road maintenance—areas where strong expertise has been developed. Sampo-Rosenlew's combine harvesters are tailored to medium-scale farms and perform reliably in varied crop and terrain types, with 90% of machine output exported to over 50 countries.

Other mobile machines (e.g., defense) account for the remaining 5–10% of industry revenue. Companies such as Patria Land Oy and Millog Oy support national defense capabilities with armored vehicles and maintenance services. These companies also benefit from dual-use technological advancements originally developed in civilian mobile machine sectors such as forestry and mining, particularly in areas like automation, remote operation, energy efficiency, and all-terrain capabilities.

Photo: Kalmar Oyj

Domain of expertise: Sustainability

Finland is positioned as a global sustainability leader in the transition to low-emission mobile machine solutions and seeks to further build its competitive edge within the sustainability/green domain.

A continuously growing network of companies delivers, e.g., **electric and hybrid solutions** that reduce environmental impact across sectors. For example, Sandvik Mining and Rock Solutions leads in battery-electric mining equipment with models like the Toro LH514BE, reducing underground emissions and improving air quality. Ponsse has launched the EV1 electric forwarder, developed in collaboration with Epec, whose Epec Flow systems support off-highway electrification. Kalmar offers electric and hybrid cargo handling equipment to cut emissions in ports, while Normet produces battery-electric tunneling and utility vehicles under its SmartDrive range. Valtra contributes to climate-smart agriculture with hybrid drivetrains and low-emission technologies. Technology providers, such as Danfoss Editron, further reinforce Finland's early leadership in zero-emission machines with drivetrains. In addition, Finland's development of energy technologies optimized for cold and demanding conditions has laid the groundwork for solutions that are increasingly relevant even within high-volume industrial markets.

Finland's research and development efforts in **sustainability and electrification** are driven by top universities and research institutions such as VTT. Fuel efficiency is increasing through the introduction of new technologies and solutions, while emission management efforts are supported by research collaboration between engine manufacturers and universities to develop cleaner mobile machine applications. Test centers such as VTT's Bioruukki and LUT Green Campus also provide platforms for piloting clean energy and electrification technologies under real-world industrial conditions. These efforts are supported by major national and Europe-wide programs, including Business Finland's leading company initiative and EU Horizon funding. For example, large-scale leading company ecosystem projects are focused on accelerating electrification, developing energy-efficient components, and enhancing digitalization in heavy-duty applications. These initiatives exemplify the strong ecosystem collaboration in driving sustainable and scalable innovation through real-world testing and development.

The country's **battery value chain** is strengthened by its domestic reserves of critical minerals like nickel, cobalt, and lithium, as well as refining capabilities and growing investments in battery recycling, with Fortum being a notable example. Finland's National Battery Strategy 2025 aims to position the country as a leader in sustainable battery manufacturing through localized sourcing, battery cell production, and circular economy practices. Finland's cold-climate testing environments, including UTAC Ivalo, Aurora Snowbox, and NUVE-LAB, give Finnish machines a competitive edge in Arctic conditions. Applied R&D is conducted at specialized facilities such as Tampere University's IHA labs for hybrid and autonomous powertrains and Sandvik's underground test mine for battery-electric mining vehicles.

Photo: Juntan Oy

Domain of expertise: Automation

Finland's mobile machine industry is also at the forefront of **automation** with a dense network of companies and research organizations that are rapidly pushing the field forward. Across sectors, Finnish machines are becoming more autonomous, connected, and responsive, built not just to handle demanding tasks but to sense, adapt, and make decisions in real time. The combination of complex use cases, advanced engineering, and capabilities in AI, robotics, and data integration makes this industry an ideal environment for developing and refining emerging technologies. A high level of trust and tight-knit networks make agile collaboration across industries easier in Finland. At the same time, Finland has a diverse industrial base, advanced technologies, and varied operating environments, which create fertile ground for experimentation and rapid iteration. As a result, it has become a launchpad for innovations and business models that can extend well beyond the machines themselves. This cross-sectoral diversity also supports the real-world collection and use of data to train intelligent machines and software, accelerating the development and deployment of autonomous systems.

Finnish firms are already making notable strides in this field. Sandvik develops autonomous and remote-controlled mining systems through its proprietary AutoMine and OptiMine platforms, with major R&D and development activities based in Finland. Kalmar advances automated yard equipment and integrates V2X systems and digital twins, leveraging private 5G networks. Ponsse has piloted remote service solutions, for example, enabling remote access to forestry machines for diagnostics and software updates, and offers fleet insights via its Ponsse Manager system. Valtra's 5G remote-controlled tractor showcases autonomous agriculture, with remote supervision of tasks in hazardous or remote areas.

This industrial capability is backed by a strong tech ecosystem. For example, Nokia builds private industrial 5G and 6G networks and edge platforms designed for real-time machine control. Smaller technology firms like Unikie and GIM Robotics contribute critical software for autonomy, teleoperation, and navigation. Ioxio supports the industry by connecting company systems across organizations, enabling seamless data exchange and automation. Meanwhile, Silo AI enhances machine intelligence through predictive maintenance and real-time optimization tools. Additional key players include Creanex and Novatron, which provide simulation platforms, automation systems, and precision control solutions, making them vital contributors and partners for OEMs.

Finland's strong base of R&D organizations, including VTT, Tampere University, and University of Oulu, drives advances in robotics, sensors, and human-machine interaction. Specialized testing environments, including OuluZone+, Sodankylä Arctic Track, and Aurora Snowbox, allow for system validation in harsh conditions.

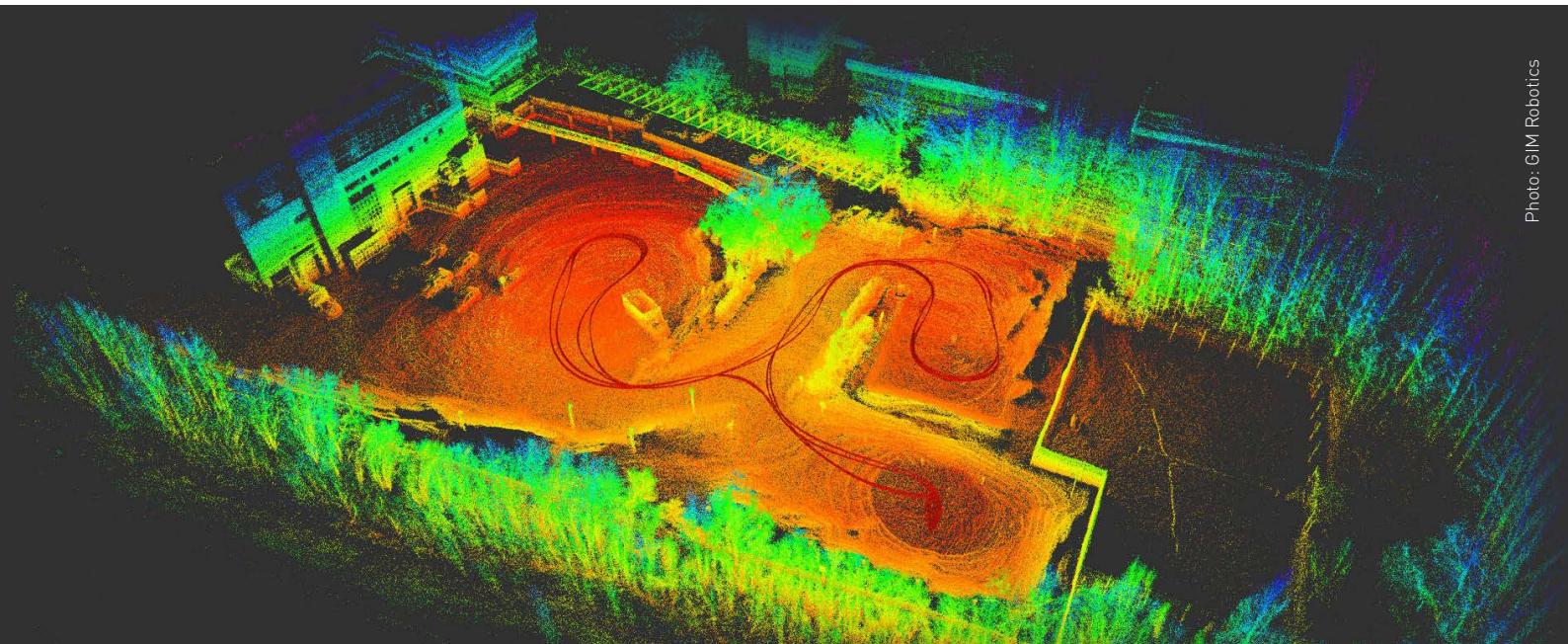


Photo: GIM Robotics

Business environment

Strengths of the Finnish business environment

Finland offers a uniquely collaborative and innovation-driven environment for mobile machines development. Its tightly knit industrial ecosystem fosters close cooperation among manufacturers, suppliers, research institutes, and academia. This environment helps to accelerate the adoption of emerging technologies such as automation, electrification, and intelligent systems and is further supported by a stable regulatory landscape, reliable clean energy, a highly skilled talent pool, and strong applied research capabilities. These factors together make Finland an optimal place for building, testing, and scaling technology for international markets.

The competitiveness of Finland's business environment is clearly demonstrated by international investments in Finland's mobile machine industry. John Deere's acquisition of Timberjack in 2000 and AGCO's acquisition of Valtra in 2004 are prime examples. Since these acquisitions, both companies have continued to heavily invest in their operations in Finland: John Deere has invested more than €400 million in local production facilities and R&D, while AGCO has put more than €170 million into expanding its manufacturing capacity and strengthening its technology development competencies. At John Deere Forestry's factory in Joensuu, approximately 80% of components are sourced from domestic suppliers, which reflects the depth, efficiency, and reliability of Finland's local industrial network. These long-term commitments highlight Finland's appeal as a strategic base for industrial operations, driven by its skilled workforce, stable operating environment, and strong alignment between local capabilities and global business goals.

Key strengths of the Finnish business environment:

- **Stable national operating environment:** Finland offers a stable, transparent, and low-corruption operating environment, providing a reliable foundation for businesses and investments. The World Bank's 2023 Governance Indicators rank Finland among the global leaders in areas such as rule of law, regulatory quality, and corruption control, outperforming global peers such as Sweden, France, Germany, the US, and China.
- **Cheap and clean energy:** Finland offers reliable access to affordable, clean energy with solid transmission infrastructure, which is particularly valuable for energy-intensive sectors like mobile machine manufacturing. According to the World Economic Forum's Fostering Effective Energy Transition 2024 report, Finland ranks 3rd globally in the Energy Transition Index (ETI), with industrial electricity costs just €0.18/kWh—among the lowest in the EU—supported by reliable infrastructure and low-carbon intensity. Finland also ranks 4th in the 2024 Environmental Performance Index (EPI), an annual ranking by Yale and Columbia Universities that assesses countries' environmental health and sustainability.
- **Skilled talent pool:** The country is home to a well-educated workforce with skills closely aligned to industry needs. The combination of robust education systems and effective on-the-job learning practices supports talent development and productivity. This strong talent foundation is reinforced by a competitive labor cost profile. For example, the annual total cost for a skilled production operative in Finland is ~€43,000 compared to ~€47,000 in Germany, according to fDi Benchmark from the Financial Times Ltd. (2022).
- **Strong education system:** Finland's vocational and university education programs are well-matched to company requirements, reinforcing workforce quality and adaptability. According to Statistics Finland (2021), 34,000 ICT and engineering students graduate annually. Finland ranks first in the OECD Better Life Index for educational attainment and student performance.
- **Applied research:** Finland has strong capabilities applied in research related to mobile machines, with expertise in autonomy for demanding environments, electrification, advanced sensing technologies, and applied AI. Finnish universities and research institutes have good connections to local industry players and other international research institutes, fostering an environment for world-class applied research.
- **Effective industrial collaboration:** There is a strong tradition of trust and collaboration among industry stakeholders, as well as between industry and academia. Ecosystem players such as SIX MWM cluster, FIMA, and DIMECC enable companies, researchers, and tech developers to co-develop new solutions, helping translate academic research into industrial applications. A culture of open dialogue and joint development efforts enhances innovation and technology transfer. Finland is setting the international benchmark in the EU for industrial collaboration with the SIX MWM cluster and Business Finland's leading company projects.
- **Access to funding:** When business fundamentals are strong, funding is generally available and accessible, supporting both scaling and innovation. Finnish companies have successfully leveraged EU-level funding programs like Horizon Europe, while Business Finland offers various funding instruments, including grants and loans, to facilitate R&D activities and the commercialization of innovations.

Present constraints and inefficiencies in the business environment

Finland's strong business foundation provides a solid base for growth, but based on industry interviews and national mobile machine survey responses, certain constraints and inefficiencies currently limit competitiveness. Strategic initiatives in the strategy chapter aim to both further strengthen current strengths and address the identified improvement areas (please see the strategy chapter for further details).

While there is strong potential for international success, several areas present opportunities for improvement. Private firms could benefit from greater support to enhance their ambition and scaling capabilities, helping turn innovation into global impact. The regulatory environment is largely seen as positive, though optimizing permitting processes and administrative efficiency would further strengthen it. Increasing international visibility and engagement, especially within EU networks, can boost foreign investment, partnerships, and talent attraction. Strengthening education-industry alignment and making it easier for international talent to stay post-graduation would enhance workforce readiness. Access to funding for startups and scale-ups can be improved with more structured support. Similarly, clearer university-industry collaboration and more focused research agendas could drive impactful innovation, with venture alliances like Combient Foundry already showing promise in fostering partnerships between startups and established companies.

Global Industry Dynamics & Future Drivers

Global landscape —market growth, trends, and dynamics

The global mobile machine industry is projected to grow from ~€730 billion in 2024 to €1.3 trillion by 2035, at a compound annual growth rate (CAGR) of 5.3%. This includes machines used across five key sectors: forestry, mining, construction, agriculture, and material handling. All sectors are shaped by a number of common trends and are expected to grow.

However, each sector differs in terms of growth rates, key drivers, and market dynamics. As Finland's position is discussed in detail in the previous chapter – also including the overarching strengths – this chapter will focus on the key drivers and market dynamics of the five key sectors.

EXHIBIT 6: GLOBAL ANNUAL SALES OF MOBILE MACHINES AND PARTS (€B, 2024 & 2035) AND KEY OVERALL MARKET DRIVERS, DYNAMICS, AND FINLAND'S POSITION WITHIN THE SECTOR

Global annual sales of mobile machines and parts (€B, 2024-2035)

	2024	CAGR, '24-'35	2035	Key drivers	Market dynamics	Finland's position
Forestry	9	+3.8%	13	• Rising timber & wood demand • Labor shortages & increased mechanization • Stricter environmental, forestry regulation, deforestation concerns	• Specialization, innovation, and uptime critical as automation grows • Low-cost rivals gain share in lower-cost segments • Low electrification; hybrids preferred	• Global leader in cut-to-length forestry solutions and data-driven forest management
Mining	144	+5.9%	270	• Increasing demand for minerals and metals • Aging fleet replacements • Stricter environmental and safety regulations	• Driven by durability, uptime, and tech leadership • Low-cost players with improved offering • Automation, digital & remote solutions • Low electrification in heavy-duty use	• Leading hub for hard-rock mining solutions and automation systems
Material (& cargo) handling	166	+5.4%	296	• Growth in logistics, e-commerce, industrial activity • Automation & digitalization of warehouses and terminals • Labor shortages	• High-cost pressure in basic segments • Electrification advancing rapidly • Automation & digital platforms reshaping operations • Uptime, safety, and service support key	• Global front-runner in port logistics and terminal automation
Agriculture	168	+5.3%	297	• Increasing food demand and commodity prices • Labor shortage, mechanization and smart farming adoptions • Climate policy support & regul.	• Smart tech, sustainability, efficiency drive success – precision farming • Low-cost entrants expanding in basic but functional equipment • Electrification led by small machines	• Specialist in multi-purpose, northern climate adopted tractors, and reliable harvesters
Construction	244	+4.8%	410	• Urbanization (housing needs) & infrastructure investments • Aging fleet renewal, labor needs • Emissions regulations in construction sites	• TCO-driven market with strong low-cost competition • Success depends on uptime, tech, robust service to justify premium • Medium-level of electrification	• Strengths in selected focus domains - in compact loaders, pile-driving rigs, and high-reach platforms
Total	**€730B**	+5.3%	**€1,300B**			

Data source: BCG Off-Highway Market Model, Interact Analysis, PSR – Power Systems Research, Freedonia

All sectors of the mobile machine industry are being shaped by macroeconomic trends, constantly developing technologies, and emerging business models. These trends drive growth and fundamentally redefine how value is created across the sector.

At the macro level, geographic fragmentation, increasing regulatory demands[9], and the push for cleaner solutions are encouraging more localized operations and sustainable end-to-end solutions, starting from design. At the same time, growing cities and population increase the demand for infrastructure and raw materials, while the mobile machine industry is facing labor shortages. For mobile machine companies, these macro shifts present significant growth opportunities, particularly for those that can tailor their offerings to local needs with sustainable and user-centric machines and solutions.

Technological advances are helping the industry adapt to macro shifts. Electrification, autonomy, robotics, and AI are enabling cleaner, safer, and more efficient operations. Alternative power sources (e.g., electric, fuel cell, hydrogen-powered) are replacing internal combustion engines (ICE) and help companies to reduce emissions and to cut operating costs. Autonomy and robotics address labor gaps and safety, while smart controls and AI-driven systems optimize performance and reduce downtime. To stay competitive, mobile machine companies must invest beyond hardware into software, data, and system integration, while ensuring that their hardware is integrable with current and future use cases and applications.

Business models are evolving as well. OEMs are shifting from selling equipment to delivering services and comprehensive solutions such as Equipment-as-a-Service, fleet optimization, and performance-based offerings. For winning players, the concept of 'machines as an enabling platform' is rapidly becoming the required mindset in the mobile machine sector. These models require rethinking value delivery and strengthening customer relationships through measurable outcomes.

[9] For example, in the context of sustainability, Regulation (EU) 2025/14 supports emission control by requiring compliance with Stage V limits through type-approval, technical testing, and market surveillance. The U.S. EPA Tier 5 is a proposed emissions standard for nonroad diesel engines aiming to further reduce emissions such as nitrogen oxides and particulate matter from new, off-road compression-ignition engines.

Photo: Normet Oy

Trends across selected mobile machine industry sectors

Forestry

Global forestry growth is driven by demand for timber and wood products in end-user sectors, like manufacturing, construction, and e-commerce. Although it is the slowest-growing sector, forestry plays a key role in the transition to sustainable materials due to the development of new wood-composite materials and wood products. Growth is further supported by increased use of machine-intensive logging in developing countries, new forestry regulations, and labor shortages linked to remote working conditions. Adoption of automation and smart technologies is increasing, improving efficiency, accuracy, and safety. Meanwhile, sustainable forestry practices are on the rise, backed up by government efforts and industry practices. However, deforestation concerns are constraining forestry operations and hence limiting to some level demand for forestry machines. This is driven by growing environmental awareness, climate commitments, and stricter regulations (e.g., driven by the Paris Agreement and the United Nations' Sustainable Development Goals).

Succeeding in today's evolving landscape requires focus on innovation, uptime, and sustainability. This is especially critical as new entrants are entering the market with lower-priced solutions due to lower labor costs, government subsidies, and a strong focus on R&D. To stay competitive, established players must prioritize innovative R&D activity in an increasingly eco-conscious market. Companies must focus on developing solutions with improved fuel efficiency, reduced emission, and enhanced automation capabilities. Smart technologies that enhance efficiency, accuracy, and safety are becoming a key differentiator, and it is important to maintain customer loyalty via comprehensive aftermarket support (e.g., spare parts availability, technical support) and the ability to adapt to changing needs, such as integrated forest management solutions. At the same time, electric and hybrid machines are gaining traction, though battery-electric vehicles remain less feasible in remote or heavy-duty contexts, hence making hybrid technology increasingly important.


Photo: Ponsse Oyj

Mining

Mining is the fastest-growing sector, driven by increasing global demand for critical minerals and metals. This growth is driven by the expansion of agriculture, construction, and manufacturing, as well as advanced applications such as electric vehicles (EVs), electronics, and durable goods. The sector is undergoing a broad replacement of aging fleets across global operations with a shift to more modern machines and advanced solutions—especially in automation and sustainability in mining operations. Stricter environmental and safety regulations, hazardous working conditions, and persistent labor shortages are accelerating the adoption of automation, remote operations, and advanced technologies.

To stay competitive in the changing market, industry players must address intensifying cost pressure from new entrants offering lower-priced, increasingly competitive technology and comparable uptime to price-sensitive segments. The competition is expanding beyond hardware, as technology firms and strategic alliances reshape the landscape with integrated analytics, energy management, and digital service solutions.

Established players are leaning more heavily on brand trust, comprehensive lifecycle services, and integrated digital platforms. Success now depends on more than mechanical durability; it requires autonomy-ready machines and reliable support within and beyond the machine (e.g., predictive maintenance, AI-powered fleet optimization)—with sustainability embedded in it. Equipment uptime remains critical, and leading market players differentiate with proprietary autonomous haulage systems, advanced fleet management software, and continuous product innovation.

Electrification is gaining traction due to its significant potential to reduce fuel and maintenance costs, improve safety (especially in underground environments), and lower emissions from operations. However, adoption remains slow—with only one-fifth of global new unit sales expected to be electrified by 2035—due to hard-to-electrify applications.

Photo: Sandvik Mining and Construction

Material handling

Material handling is experiencing strong growth, driven by the expansion of e-commerce, global trade, and increasing demand for logistics automation. Companies face growing pressure to improve efficiency, shorten delivery times, and address labor shortages, prompting rapid adoption of more intelligent, safer, and cleaner equipment. Regulatory measures such as Europe's Stage V emissions standards and California's zero-emission mandates are accelerating the transition away from diesel-powered machines.

To succeed in this evolving market, companies must deliver durable, electrified, and increasingly automated solutions while managing cost pressure from emerging-market manufacturers. To win in this industry, companies must meet rising customer expectations for uptime, sustainability, and service. Strong performance now depends not only on hardware reliability but also on advanced technologies that enhance efficiency, connectivity, and support.

Electrification and automation are transforming the sector. By 2035, the majority of material handling equipment is expected to be powered by electric or hydrogen systems. Battery-electric platforms are already standard in many indoor and light-duty applications, while hydrogen is gaining traction in heavier and outdoor use cases. Meanwhile, automation is reshaping operations through self-driving mobile robots and automated transport vehicles integrated with digital platforms that enable predictive maintenance, real-time monitoring, and fleet optimization.

Photo: Kalmar Oyj

Agriculture

The global agricultural sector is experiencing steady growth, supported by population growth, rising personal incomes, and higher commodity prices. At the same time, labor shortages and wage pressures are accelerating the adoption of new technologies, including precision tools, smart equipment, and automation—while farmers are replacing aging fleets. Governments are supporting the shift towards modern agriculture through subsidies, rental programs, and climate-focused incentives[10]. Simultaneously, climate resilience and new regulations are also accelerating investment in sustainable equipment and raising mechanization rates across markets.

Together, these trends are reshaping the agricultural machine landscape. Low-cost competition is expanding in price-sensitive markets by offering affordable, simplified machines tailored to local operating conditions. Market players are expected to go beyond machine performance, offering technologies that deliver clear value for farmers while adapting to local needs and regulations (e.g., regarding sustainability, this can be seen through the EU's Fit for 55 set of legislative proposals[11]).

Digitalization is gaining traction, with AI and IoT integration enabling data-driven decision-making and AI recommendations, remote diagnostics, and optimized equipment and input utilization. These capabilities are becoming key differentiators in a market increasingly focused on precision farming and operational resilience. The market is also expanding as, e.g., governments are increasingly supporting the adoption of agriculture drones around the world.

Electrification is also advancing, with nearly 50% of new sales units expected to be electrified by 2035. Battery adoption is mainly driven by small tractors, while hydrogen and hybrid powertrains are emerging as a promising solution for large tractors and harvesters, where battery weight can lead to soil compaction. However, it is good to keep in mind that the pace of hydrogen adoption will depend heavily on fuel availability and infrastructure development.

[11] A couple examples in the field to mention, the EU has the Common Agriculture Policy (CAP) which aims to support farmers, ensure an affordable and stable food supply, and promote rural development and environmental sustainability. In Kenya, Hello Tractor – an agriculture platform – is reshaping the agricultural landscape and empowering rural communities by providing smallholders with access to financing for tractors.

[12] The Fit for 55 is the EU's goal of reaching climate neutrality by 2050 and of cutting net greenhouse gas emissions by at least 55% compared to 1990 levels by 2030 by, for example, reducing emissions from transport, buildings, agriculture, and waste.

Photo: Valtra, AGCO Corporation

Construction

Construction, the largest sector, is experiencing steady growth fueled by population growth, urbanization, infrastructure investment, and rising mechanization in emerging markets. All regions are seeing an increase in unit sales of construction machines. The need to replace aging fleets and address labor shortages is driving the adoption of new advanced technologies. In a highly cost-competitive market, low-cost emerging-market players are gaining share with affordable and increasingly capable equipment. Regulations and urban noise limits are reinforcing the demand for lower emission machines. For example, cities like Oslo, London, and Los Angeles, as part of the C40 Cities initiative, have committed to zero-emission construction sites for public projects.

To succeed in this evolving landscape, companies need to stand out with strong electrification strategies and smart technologies like automation and connectivity. At the same time, they have to keep equipment affordable to stay competitive. There is also growing pressure to meet expectations around sustainability, reliable performance, and smooth integration with digital systems.

Over 50% of new unit sales are expected to be electrified by 2035, with battery-powered machines gaining traction in small equipment, such as compact excavators, while hydrogen is emerging as a viable solution for larger vehicles, where battery constraints remain. Automation is also reshaping the sector. Semi-automation, autonomy, and remote control are expanding in tasks like grading and trenching, easing labor shortages and improving efficiency. Connectivity is unlocking new value through predictive maintenance, fleet optimization, and integration with digital workflows.

Photo: Junttan Oy

Investment flows

Recent investment data highlights that the industry is actively responding to global trends. An analysis of approximately 500 major investments and M&A transactions executed by the top 100 largest off-highway equipment manufacturers (2020–2025) underlines how capital is employed to transform the mobile machine industry. As shown in Exhibit 8, two investment themes stand out: digital solutions and climate & sustainability. This clearly illustrates that while companies continue to scale their businesses through investments in core equipment and distribution capabilities, they simultaneously build their digital and sustainability capabilities in response to global trends to remain and strengthen their competitive differentiation.

- **Equipment and distribution:** During the analyzed period of 2020-2025, >50% of total investment (€17.1 billion) was directed towards core machines and distribution capability. This reflects a continued focus on increasing efficiency and consolidating the market.
- **Climate and sustainability:** ~20% (€7.1 billion) was invested towards low-emission, energy-efficient, and environmentally compliant solutions. Battery technologies were the most heavily invested sub-theme, a particularly prominent theme within the construction, mining, and material handling industries, underlining the shift towards electrification of equipment. Investments in EV components, renewables, and hydrogen have been less prominent, perhaps suggesting market participants foresee these topics remaining more niche application areas.
- **Digital solutions:** ~15% (€5.8 billion) was allocated to technologies such as automation, telematics, and data-driven services highlighting the industry's ambition to move towards smarter, better-connected machines. Automation, autonomy, and fleet & asset management received the most investment across industry sectors, as they are essential for improving efficiency, to enable remote operations, and to address labor shortages. Construction, agriculture, and mining industry sectors show a strong focus towards these areas—particularly visible is the agriculture industry's notable investment flows towards precision farming technologies.

EXHIBIT 7: RECENT INVESTMENT AND M&A ACTIVITY THEMES OF MOBILE MACHINE INCUMBENTS (TOP 100 OFF-HIGHWAY EQUIPMENT MANUFACTURERS, 2020-2025)

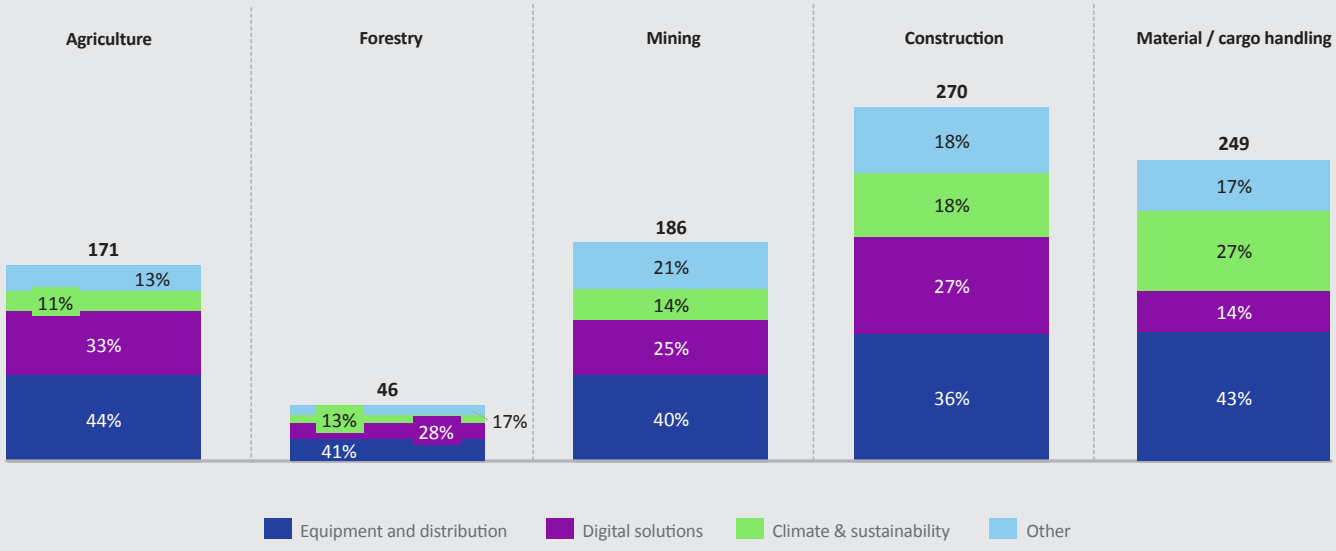
The network shows how companies are connected based on shared keywords. Nodes represent companies, grouped into clusters by theme. Links show shared terms, and proximity reflects how closely clusters are related. Isolated nodes lack connections, while white spaces indicate potential opportunities to link themes

Source: S&P Capital IQ; Quid; BCG Center for Growth & Innovation Analytics

The total number of investments per industry is fairly proportional to the relative size of each industry sector. The construction sector has executed the most investment and M&A transactions and constitutes the largest mobile machine industry segment globally. Conversely, forestry is the smallest industry sector with the smallest number of investment events. Most investments across all five sectors focus on equipment and distribution, although there is some variation between the themes. Notably, material and cargo handling companies have allocated the largest share of their investments towards climate and sustainability (27%), whereas digital solutions have attracted a smaller share of overall investments (14%) over the past five years. The other focus industries (agriculture, forestry, mining, construction) have shown comparable levels of investments towards digital solutions, ranging between 25% and 33%.

EXHIBIT 8: NUMBER OF **PRIVATE PLACEMENTS AND M&A BY INDUSTRY** (AGGREGATED NUMBER OF EVENTS, 2020–2025. INVESTMENTS BY COMPANIES ACTIVE IN MULTIPLE INDUSTRIES ARE INCLUDED IN ALL APPLICABLE INDUSTRY CATEGORIES)

Aggregated number of events, 2020–2025, Investments by companies active in multiple industries are included in all applicable in dustry categories; therefore, the total exceeds the 500 individual transactions



Semantic analysis based on ~500 investment and M&A targets of top ~100 off-highway equipment manufacturers since 2020.
Source: S&P Capital IQ; Quid; BCG Center for Growth & Innovation Analytics

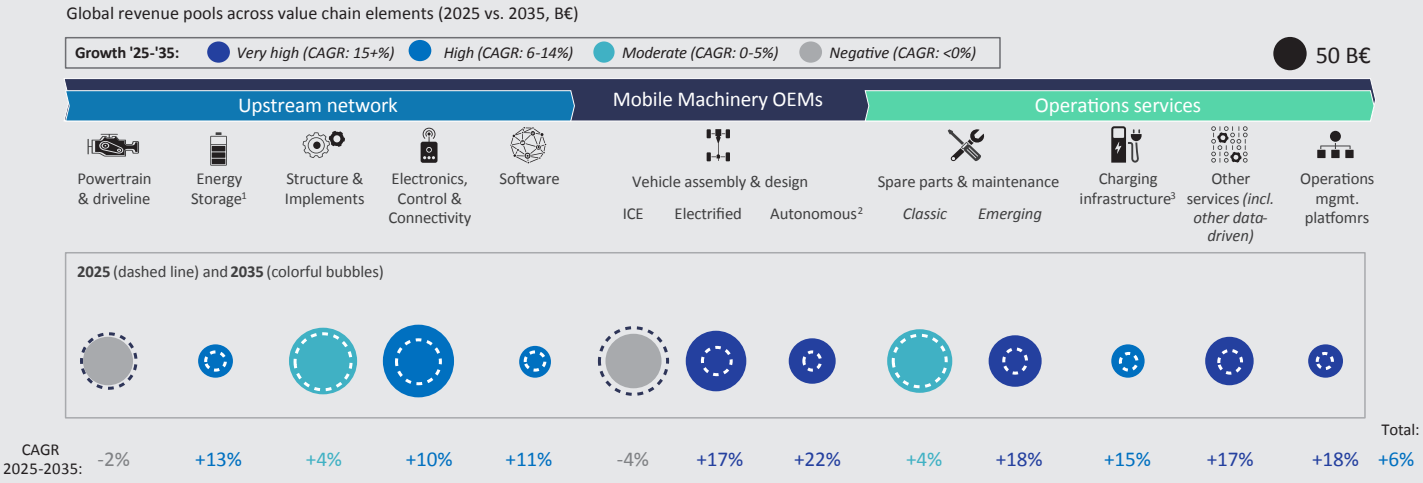
Value creation

Future revenue pools in the mobile machine industry

The investment trends illustrate a fundamental shift where future value is created within the mobile machine industry. While the industry is positioned for strong growth over the next decade, it is also experiencing its most significant technological disruption to date. This disruption is being driven by factors such as digitalization and green transition. Successful navigation of these shifts requires a clear understanding of where value is created today—and, more importantly, where value will be created in the future.

Understanding this evolving market landscape involves assessing revenue pools—specific parts of the value chain, such as components, design and assembly, and spare parts. These pools reveal where revenue is currently generated across the value chain and provide a view of their potential evolution in the future, helping to guide strategic focus towards the most promising areas for growth. The value chain spans the entire lifecycle from component manufacturing to machine design and assembly, and ultimately to end-user services, irrespective of which industry stakeholder delivers these activities or sells a particular product or service. Although the revenue pools show where the industry is heading towards, this high-level view does not cover the entire future landscape—value will also likely be generated beyond the assessed value chain components.

EXHIBIT 9: TOTAL GLOBAL REVENUE POOLS ACROSS THE MOBILE MACHINE INDUSTRY'S VALUE CHAIN, 2025 VS. 2035



1. Based primarily on battery-electric vehicles (BEV), includes volume estimates for fuel cell and hydrogen ICE as well. 2. The ICE and electrified design and assembly overlap partly with autonomous machines design and assembly, hence, the sum of these three buckets is more than 100%. 3. Includes hardware, grid connection, and installation. Assumes BEV as the base case, with fuel cell and H2ICE volumes considered.

Source: Interact, Power System Research, Expert interviews, Desktop research, BCG analysis

Looking ahead, the evolution of these revenue pools is set to change significantly. As Exhibit 9 shows, in 2025, the largest revenue pools are tied to traditional technologies, particularly internal combustion engine (ICE) systems[12] and related mechanical components. By 2035, this picture will look very different: value is expected to sharply shift towards components, technologies, and services that support electrification, autonomy, and digital enablement, many of these value pools are projected to grow at a double-digit rate on an annual basis.

The shift is particularly evident in the following key areas:

- **Energy storage** (2025-2035 CAGR of +13%)
  Energy storage-related revenue is expected to grow as due to the increasing demand for sustainable energy solutions and the general electrification of the machines. However, decreasing component prices and increasing commoditization limit revenue growth despite increasing volumes.
- **Electronics, Control, and Connectivity** (+10%)
  Rapidly developing technologies are expected to become prominent enablers for both electrified and autonomous machines. Growth is expected to be driven by the increasing need for real-time sensing, machine-to-machine communication, and advanced control systems that support electric drivetrains and autonomous functionality.
- **Software** (+11%)
  Software is expected to become an even more prominent enabling differentiator to further develop machine functionality, diagnostics, remote updates, and new service-based business models.
- **Electrified and autonomous vehicle platforms** (+17% and +22%, respectively)[13]
  The growth of electrified and autonomous vehicles is fueled by structural market-shaping drivers such as labor shortages, stricter emission and safety regulations, and advancements within automation technology. Adoption of these more-novel technologies will accelerate especially in lower power range machines and controlled environments and simpler tasks. However, the suitability of these solutions to more complex environments and terrain, and heavy-duty applications is lower – hence making the technological transition slower.
- **Emerging spare parts and maintenance** (+18%)
  As the fleet of electrified and sensor-equipped machines grows, so does the demand for specialized spare parts and new, more advanced maintenance models. Examples of these maintenance models include predictive maintenance, remote diagnostics, and software-enabled interventions – all of which contribute to higher overall service value.
- **Charging infrastructure** (+15%)
  Increasing number of electrified machines increases demand for associated infrastructure and supporting services, such as charging hardware, grid connection, and installation services. This increased infrastructure need is particularly prominent at remote sites that currently have limited or no existing infrastructure in place.
- **Operations management platforms** (+18%) and **other services**[14] (+17%)
  New services will enable more efficient machine usage, lifecycle optimization, and new forms of value creation through digital integration. Equipment-as-a-service and performance-based-models will also play a key role in this shift and provide substantial business opportunities for the industry participants.

While these high-growth areas are expected to reshape the industry's revenue pool structure, many existing mature revenue pools will remain relevant. Notably, structure and implements (+4%) and classic spare parts (+4%) will continue to be sizeable revenue pools, despite the fact that their share of total revenue decreases.

In this rapidly evolving operating and business environment, competitive advantage will increasingly come from offering end-to-end, integrated solutions that span across the full value chain—from upstream supply to machine design and lifetime operations / downstream services. Equally important is the ability to capture the value of new services through clear monetization models – in contrast to the status quo where many digital or software-driven offerings are often not fully reflected in the pricing of rendered services but rather granted for free in the name of good customer service.

[12] The Powertrain and drivetrain pool includes traditional ICE engine, drivetrain, and electric drive system and hence, the annual decrease does not show the full picture.

[13] The ICE and electrified design and assembly overlap partly with autonomous machines design and assembly, hence, the sum of these three buckets is more than the actual total.

[14] Includes e.g., equipment-as-a-Service, data analytics and predictive insights, remote and digital support services, and subscription-based services.

Comparison with the broader automotive industry: A parallel shift in value pools

The findings for the Mobile Machine industry are aligned with those of the broader automotive sector, which is undergoing disruption driven by electrification, automation, digitalization, and shifting customer expectations. Total global automotive industry revenue is projected to grow from $4.9 trillion in 2021 to $8.0 trillion by 2035, increasingly fueled by emerging value pools such as battery-electric vehicles (BEVs), digital services, and new mobility models.

At the same time, the majority of profit growth is expected to shift away from traditional sources like internal combustion engine (ICE) vehicles and classic aftersales. Instead, value is expected to concentrate in areas such as battery-electric vehicle (BEV) and autonomous vehicle (AV) components, connected services, and mobility platforms—with these pools projected to grow from just 10% of total industry profits in 2021 to a whopping 56% by 2035. Mobile machine-related revenue pools are expected to follow a similar direction of travel, although the trajectory will be more gradual—and uneven across industry segments— due to diverse use cases and varying operating conditions.

New business models are also emerging beyond the automotive industry itself. Software-defined features, functions-on-demand, charging solutions, and data monetization are reshaping how value is created and captured. External pressures, including tightening ICE regulations, supply chain shifts, and evolving consumer behavior and expectations, are accelerating the transformation across both industries.

The ongoing shift in revenue pools underscores the need to adapt to a changing mobile machine value landscape. Companies will need to assess how well their current strategic positions align with the emerging sources of value—and where strategic adjustments are called for to remain competitive as the industry evolves. Key considerations include not only technological and R&D capabilities but also business models, partnerships, and go-to-market approaches that reflect the increasing role of digital and service-based offerings are expected to play in the future.

Photo: Sandvik Mining and Construcion Oy

Understanding value from revenue pools – customers at the center

While revenue pools offer a directional view of where the industry is headed, not all growth is created equal. Revenue pools differ with respect to their margin profiles, capital intensity, and strategic potential.

Stable, high-margin value pools, such as classic spare parts, continue to remain highly profitable and serve as an essential source of business for their producers. Subscription-based offerings, while still at the early stages of evolution, show promise given their potential as scalable and recurring sources of revenue. Their strategic weight goes beyond their immediate financial impact: they differentiate the service provider and its offering, improve usability, and often become decisive factors in the purchase decision. Importantly, both spare parts sales and subscriptions not only contribute financially but also keep the customer relationship active and recurring—enabling the service providers to stay close to their customers and fully understand their particular circumstances and bespoke needs.

Some revenue pools, such as energy storage, are strategically important for the future of electrification but offer lower (low-to-medium) and potentially declining margins due to the expected longer-term commoditization as the associated technologies mature and volumes increase. Meanwhile, more novel pools - for example, data-driven services - may not yet be highly profitable today, but they are becoming increasingly central to customer decision-making and hence integral parts of the offering. Many of these offerings, particularly software, often require upfront investment towards software development and organizational capabilities before returns become visible. The payoff, however, is long-term differentiation and deeper integration into customer operations.

The implication is clear: sustained growth in both revenue and profitability requires fully understanding where customer expectations and needs are shifting, which capabilities matter, and which business models are needed to deliver. Value is not only captured where margins are highest but also where differentiation is built, expectations are met, and relevance is secured.

As enhanced customer outcomes increasingly drive topline growth and margin uplift, they also become foundational to delivering stronger shareholder returns. Investors are placing increasing emphasis on companies that align technological innovation with tangible, repeatable customer benefits. Given the interconnected nature of the value pools, focusing solely on the largest or most profitable standalone value pools is not sufficient – especially when expansion into new domains demands different capabilities, business models, and investments. What may have been sufficient in the past—namely creating better machines—is no longer enough if one wishes to remain a leading player in their respective field.

As the offering landscape broadens, companies must navigate a mix of revenue pools that serve different purposes. Some will optimize for shorter-term profitability, whereas some will ensure future relevance and shape longer-term purchasing decisions. For those playing the longer game, the key is to understand that some margins might need to be 'sacrificed' to comprehensively capture the future value pools across the value chain. This is because while every part of the offering will not deliver high returns on its own, many will be critical to meeting customer needs, differentiating the offerings, or enabling pull-through towards more profitable offering areas. To fund the journey, leaders must secure strong positions in the pools that generate sufficient cash flow in the short term – to ensure they have the financial firepower to invest in the solutions that drive longer-term customer value and competitive advantage.

Customer value creation: Total value of ownership

As mentioned above, neither revenue pools nor margins tell the full story in isolation. It is also crucial to understand how value is delivered to the customer and how it translates into real-life benefits.

As discussed earlier in the report, mobile machines and solutions are rapidly advancing, and so is the customer value proposition, in tandem. According to the industry survey conducted for this report, the respondents see *product quality and reliability, machine productivity, cost-efficiency, and sustainable, low-emission solutions* to be the most relevant offering attributes to generate value and to stand out from the competition. The machine will continue to retain its central role as the enabling platform to deliver tangible benefits and outcomes for the customer / end-user. However, significant new value will also be generated beyond the machine itself, as original equipment manufacturers (OEMs) increasingly shift from offering "machines" to delivering integrated solutions—within which the machine is the enabling platform. This dynamic will increasingly transform how business is conducted and how value is created for customers—albeit the machine remaining the foundational enabling platform to render holistic and comprehensive solutions and services.

To better discuss the key elements of what customer value creation consists of, the next section focuses on the total value of ownership. In this context, the *total value of ownership* means the total value customers gain during the machine lifecycle - not only directly from the machine but also from the broader operations and solutions linked to it. The total value of ownership is, in this context, divided into three dimensions:

1. Increased productivity
2. Lower lifecycle costs
3. Safer and more sustainable operations[15]

Each of these categories will be discussed separately, but it is good to keep in mind that new, unmet value can be created within each and beyond them—critical will be to be close to the customer and to truly know their operations to create new, lasting value.

[15] Unlike the names suggest, the cost optimization and better performance are also directly linked to these elements – the achieved value is broad.

EXHIBIT 10: CUSTOMER VALUE CREATION

SUPERIOR CUSTOMER VALUE THROUGH FINNISH MOBILE MACHINES

INCREASED PRODUCTIVITY

Faster workflows, higher utilization, and smarter machine coordination

LOWER LIFECYCLE COSTS

Savings through electrification, automation, and reduced fuel and labor needs

SAFER AND MORE SUSTAINABLE OPERATIONS

Safer, smarter machines that drive health, sustainability, and performance across operations

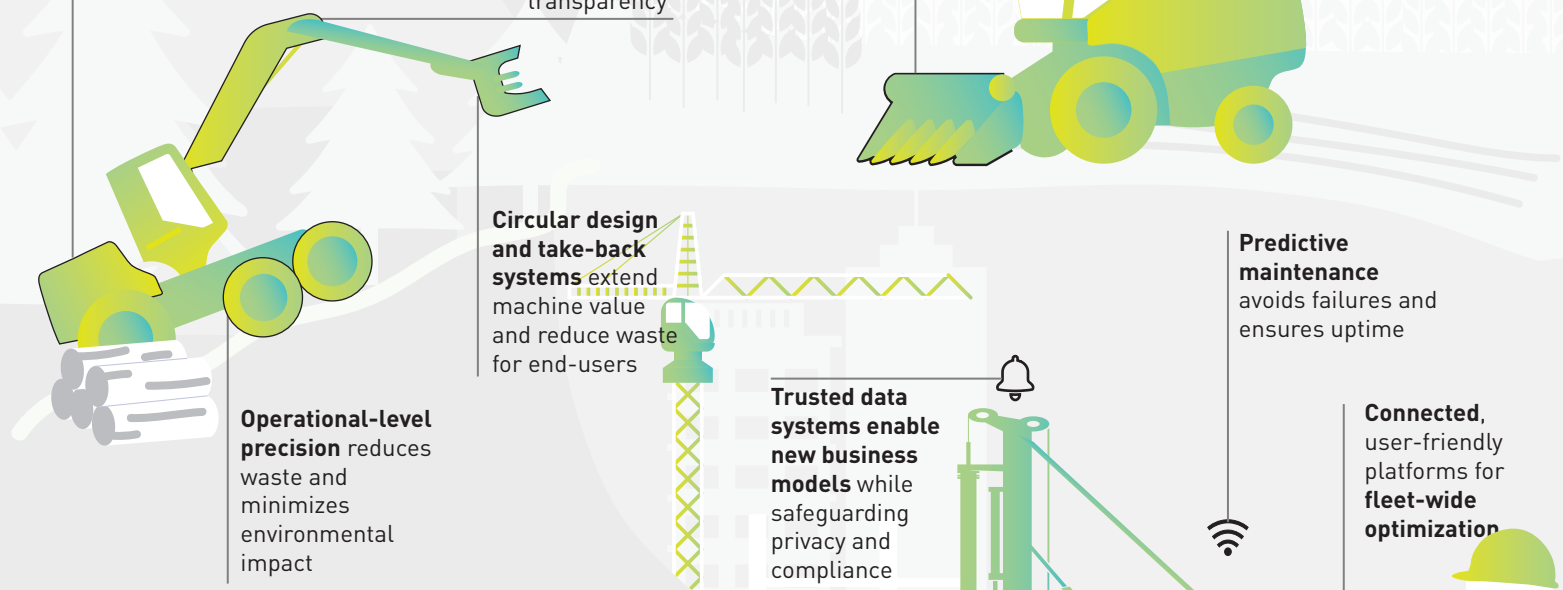
AI-powered tools optimize site planning and **operational decision-making**

Adaptable software and data structures enable companies to serve **customers in entirely new ways**

Modular design speeds repairs and reduces downtime

Electrified and next-gen powertrains cut emissions and boost efficiency

Sustainable materials and digital product tracking improve lifecycle transparency



Circular design and take-back systems extend machine value and reduce waste for end-users

Predictive maintenance avoids failures and ensures uptime

Trusted data systems enable new business models while safeguarding privacy and compliance

Connected, user-friendly platforms for **fleet-wide optimization**

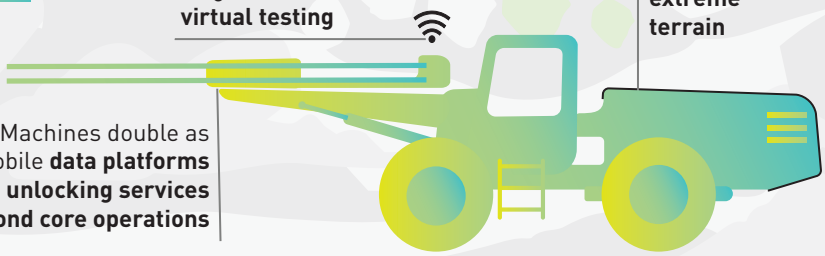
Operational-level precision reduces waste and minimizes environmental impact

Pilot and test equipment in the end-user's actual **operating environment**

Assisted and autonomous systems reduce operator workload and boost safety across all skill levels

Digital twins enable better diagnostics and **virtual testing**

Specialized engineering ensures **reliability in extreme terrain**



Connected machine fleets communicate together and coordinate around shared task objectives

Machines double as mobile **data platforms unlocking services beyond core operations**

1. Increased productivity

In industrial applications, purchasing decisions are largely driven by financial and operational priorities. As reflected in the industry survey results, customers—whether in construction, forestry, mining, agriculture, material and cargo handling, or other industries—favor machines with attractive financial profiles and improved day-to-day operations.

Fortunately, modern mobile machines and related solutions are increasingly meeting these expectations. Advancements in automation, software, connectivity, and data integration enable higher machine utilization, faster task completion, and more flexible operations. These technologies help operators manage equipment more efficiently by collecting and applying data, reducing idle time, and optimizing fleet-level performance.

Productivity gains have already started - and will increasingly continue—to go beyond individual machine performance. Customer value is created when machines work and communicate together as part of a coordinated system. For example, coordinating machine timing on a job site or balancing workloads across a fleet can reduce bottlenecks and increase throughput without adding equipment. Data-driven services increasingly support this by turning operational data into actionable insights, enabling more predictable workflows, better resource use, and higher output.

Real-time fleet visibility, predictive maintenance alerts, and task automation features support day-to-day productivity, especially in complex or resource-constrained environments. These tools help to optimize operations and make more informed, proactive decisions. The impact is already visible across industries: in agriculture, smart farming can result in higher crop yields and optimized chemical use, improving sustainability and reducing costs for users. In mining, improved utilization and less downtime boost productivity. Advanced software, including AI-powered tools, also helps with site planning and real-time decision-making, improving how resources are deployed and work gets done. Digital twins enable better diagnostics and virtual testing, and adaptable software and data structures enable companies to serve customers in entirely new industries.

As these technologies evolve, customers gain not just equipment but integrated solutions that improve overall outcomes. For this to translate into real value, solutions must be practical, reliable, and easy to adopt. Plug-and-play compatibility with planning systems and customer platforms enables faster setup, better coordination, and smarter decision-making. Consistent and reliable performance is essential for enabling stable, scalable growth.

Photo: Tana Oy

2. Lower lifecycle costs

In addition to improved productivity and growth, cost reduction will remain a key priority for industrial customers across the full lifecycle of the machine, as the majority of industry participants see that as essential for the future[16]. Changes, such as electrification and automation, will lower the total cost of ownership (TCO) and overall operating expenses, despite the overall higher initial investment. The magnitude of this advantage, however, depends on context: infrastructure readiness, machine utilization rates, operating environment, and operational complexity all influence the TCO equation—and the other operational cost savings. However, as the Medium-duty tractor example[17] in Exhibit 11 shows, the impact can be significant.

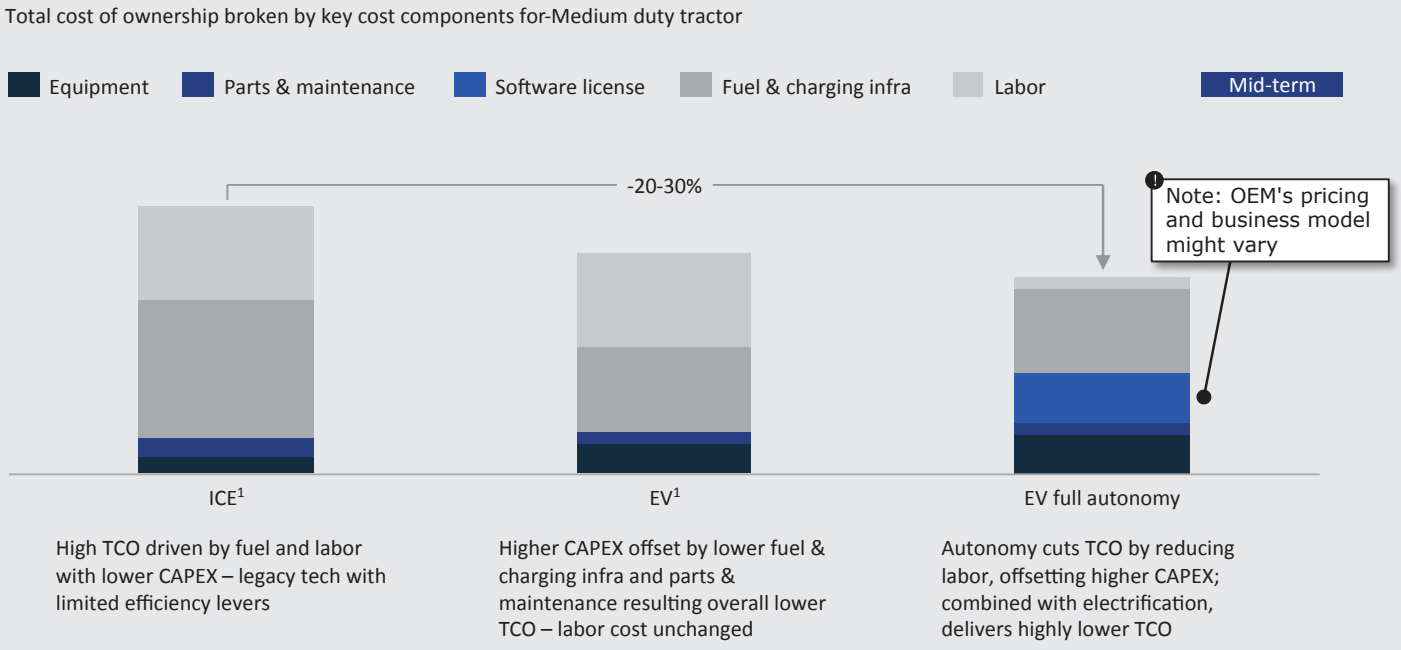
Electrification reduces fuel costs due to more efficient drivetrains and cheaper refueling, especially in high-utilization environments such as mining or material handling. Although the upfront investment, for example for charging infrastructure can be substantial, long-term savings in fuel, maintenance, and other operating costs can more than offset these. In addition to saving on fuel, electrified machines have fewer moving parts thanks to simpler drivetrain and electric motor designs. This reduces maintenance needs and contributes to further lifecycle cost savings. An example of the other operating expenses comes from mining, where electrification significantly reduces the need for ventilation by eliminating diesel emissions and lowering heat generation, leading to improved energy efficiency and lower operational costs. Switching to electrified machines and other sustainable power solutions also delivers significant emissions reductions, enabling customers to meet increasingly stringent sustainability goals—and minimizing any CO2-related costs.

Automation further contributes to cost reduction by lowering labor-related expenses, such as wages, training, and safety measures. These often make up a significant portion of a machine's lifecycle costs. As industries increasingly face shortages of skilled workforces, autonomous and digitally integrated systems offer a viable solution. Automation also allows operators to better utilize their time and capabilities on other, less redundant tasks. These technologies reduce direct labor costs, minimize dependency on highly skilled personnel, and improve safety, reliability, and operational continuity.

Beyond direct labor savings, automation generates broader operational value. Technologies help reduce idle time, improve utilization, and enable more consistent operations. Partially autonomous machines assist operators in repetitive and high-precision tasks, improving efficiency and reducing error rates, while fully autonomous systems go further, delivering predictable, even round-the-clock performance. For example, in agriculture, smart farming enables more precise and efficient use of inputs, improving productivity and sustainability, and saving costs. In forestry, automation supports optimized harvesting routes and lower environmental impact—while also lowering the skill threshold required from operators, as intelligent systems handle parts of the work autonomously.

[17] According to the mobile machine strategy survey
[18] Note that this is a general example of a medium-duty tractor and does not represent any company-specific machine.

EXHIBIT 11: TOTAL COST OF OWNERSHIP REDUCES AS MACHINES BECOME AUTONOMOUS AND ELECTRIFIED, EXAMPLE: MEDIUM-DUTY TRACTOR



1. Assumption on human-operated machines.
Source: Expert interviews; BCG analysis

3. Safer and more sustainable operations

As mobile machines and solutions become more advanced, the definition for customer value is expanding. While cost and productivity improvement remain central, safety, health, and sustainability are becoming increasingly important—areas where mobile machines as a platform can also bring value. This change is largely driven by regulation, labor challenges, and customer expectations.

Safety and operator health are products of both machine design and in-field functionality. Features like cab ergonomics, visibility, and stability can help operators to stay alert and support better control during long hours in challenging environments. Safety systems, such as obstacle detection, automatic braking, and machine stabilization, reduce the risk of incidents and promote consistent performance at the same time as automation makes machines easier to use across skill levels. In more advanced use cases, automation and remote operations reduce the need for operators to perform high-risk tasks in person.

As autonomous capabilities mature, machines are becoming increasingly better at detecting hazards, making real-time decisions, and executing repetitive and hazardous tasks independently. This does not only prevent human error but also enables a higher, more consistent safety baseline across operations, particularly in unpredictable or high-intensity environments. Overall, this helps minimize human exposure to hazardous environments and improve accessibility—not only increasing operational output but also allowing safer and healthier operations.

Sustainability is increasingly at the core of customer operations. As previously discussed, electrification helps reduce total cost of ownership and direct operational costs, making the machines faster, more precise, and more efficient, while also helping companies to meet their sustainability targets. Electrified machines help reduce on-site emissions and noise, especially in enclosed and regulated environments. One example from regulated environments is that from 2025, construction equipment is required to be emission-free for all public projects in Oslo, Norway.

But sustainability goes beyond the drivetrain and fuel choices. Using sustainable materials and tracking product components digitally makes it easier to understand the lifecycle impact of machines. Modular parts and long-lasting components reduce waste, while predictive maintenance keeps equipment running longer with fewer breakdowns. In agriculture, for instance, smart farming solutions can optimize fertilizer use, lowering the costs while, for example, also reducing excess phosphorus and nitrogen input. This improves both profitability and environmental impact, helping customers meet—and even exceed—the sustainability goals set by their own clients and regulatory requirements. And across industries, circular design and take-back systems are extending machine life, reducing waste, and supporting reuse of key components.

Circularity is also becoming a value proposition. The use of recyclable materials, re-manufacturable components, and end-of-life take-back programs can further reduce environmental impact. As these capabilities mature, they offer a way to meet sustainability targets while also unlocking new efficiencies and cost advantages. This extends beyond the direct customer to the broader value chain and stakeholders.

Photo: Valtra, AGCO Corporation

Photo: Normet Oy

Sources

Boston Consulting Group, How to Profit in Tomorrow's Automotive and Mobility Industry, by Markus Hagenmaier, Julien Bert, Augustin K. Wegscheider, Thomas Palme, Raphael Kirn, and Luis Schaber, 2023, https://web-assets.bcg.com/35/ac/ae94446e4f5994dca42960324dc6/bcg-how-to-profit-in-tomorrows-automotive-and-mobility-feb-2023.pdf [Link as of 03/06/2025]

Block, S., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. (2024). 2024 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy. epi.yale.edu

fDi Benchmark, Research Locations Worldwide, Financial Times Ltd, 2022, https://www.fdibenchmark.com/

Freedonia Group, Global Agricultural Equipment, 2024, https://www.freedoniagroup.com/industry-study/global-agricultural-equipment [Link as of 04/06/2025]

Freedonia Group, Agricultural Equipment: Europe, 2024, https://www.freedoniagroup.com/freedonia-focus/agricultural-equipment-europe-fe75037 [Link as of 04/06/2025]

Freedonia Group, Global Construction Machinery, 2023, https://www.freedoniagroup.com/industry-study/global-construction-machinery [Link as of 04/06/2025]

Freedonia Group, Global Forestry Equipment, 2023, https://www.freedoniagroup.com/industry-study/global-forestry-equipment [Link as of 04/06/2025]

Freedonia Group, Global Material Handling Equipment, 2022, https://www.freedoniagroup.com/industry-study/global-material-handling-equipment-4334.htm [Link as of 04/06/2025]

Freedonia Group, Global Mining Equipment, 2023. https://www.freedoniagroup.com/industry-study/global-mining-equipment [Links as of 04/06/2025]

Freedonia Group, Global Off-Road Equipment Market & Technology Outlook, 2023, https://www.freedoniagroup.com/industry-study/global-off-road-equipment-market-technology [Link as of 04/06/2025]

Fortune Business Insights, Agriculture Drone Market Size, Share & Industry Analysis, By Offering (Hardware and Software & Services), By Components (Frames, Control Systems, Propulsion System, Navigation System, Camera Systems, and Others), By Payload Capacity (Lightweight Drones (Upto 10 kg), Medium Weight Drones (Upto 10 - 25 Kg), and Heavy Weight Drones (Above 25 kg)), By Application (Monitoring and Mapping, Precision Farming, Irrigation Management, Crop Health Assessment, Planting and Sowing, and Data Collection and Analysis), and Regional Forecast, 2024-2032, Last updates: 02.06.2025, https://www.fortunebusinessinsights.com/agriculture-drones-market-102589 [Link as of 17/06/2025]

Fortune Business Insights, Agriculture Equipment Market Size, Share & Industry Analysis, By Equipment Type (Agriculture Tractors, Harvesting Equipment, Irrigation & Crop Processing Equipment, Agriculture Spraying & Handling Equipment, Soil Preparation & Cultivation Equipment, and Others (Hay & Forage Equipment, Trailers)), By Application (Land Development, Threshing and Harvesting, Plant Protection, and After Agro Processing), and Regional Forecast, 2025-2032, Last update 02.06.2025, https://www.fortunebusinessinsights.com/agriculture-equipment-market-102665 [Link as of 17/06/2025]

Fortune Business Insight, Forestry Equipment Market Size, Share & Industry Analysis, By Equipment Type (Felling Equipment, Extracting Equipment, On-site Processing Equipment, and Others (Mulchers, Stump Grinders, etc.)), By Sales Type (Used and New), and Regional Forecast, 2025-2032, Last update: 02.06.2025, https://www.fortunebusinessinsights.com/industry-reports/forestry-equipment-market-100560 [Link as of 17/06/2025]

Fortune Business Insights, Mining Equipment Market Size, Share & Industry Analysis, By Type (Excavators, Loaders, Dozers, Motor Graders, Dump Trucks & Others), By Application (Coal Mining, Gas & Oil Extraction, Metal Ore Mining & Non-metal Mining), and Regional Forecast, 2021-2028, Last updated: 02.06.2025, https://www.fortunebusinessinsights.com/mining-equipment-market-104970 [Link as of 16/06/2025]

Fortune Business Insights, Construction Equipment Market Size, Share & Industry Analysis, By Equipment Type (Excavators, Cranes, Loaders, Backhoe, and Others), By Application (Residential, Commercial, Industrial), and Regional Forecast, 2023–2032, Last updated: 02.06.2025, https://www.fortunebusinessinsights.com/industry-reports/construction-equipment-market-100521 [Link as of 16/06/2025]

Fortune Business Insights, Material Handling Equipment Market Size, Share & Industry Analysis, By Type (Cranes, Conveyors, Forklift, Industrial Trucks, Hoists), By System Type (Unit Load, Bulk Load), By Industry (Automotive, Food & Beverages, Chemical, Semiconductor & Electronics, E-commerce, Aviation, Others), and Regional Forecast, 2025–2034, Last updated: 02.06.2025, https://www.fortunebusinessinsights.com/industry-reports/material-handling-equipment-market-101501 [Link as of 16/06/2025]

Interact Analysis, Off-Highway Vehicles, 2024.

Ministry of Economic Affairs and Employment of Finland, National Battery Strategy 2025, February 2021, https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162685/TEM_2021_6.pdf?sequence=1 [Link as 24/06/2025]

MMR, Forestry Equipment Market Size, Share, Trends, and Forecast Analysis (2025-2032), June 2025, https://www.maximizemarketresearch.com/market-report/global-forestry-equipment-market/101160/ [Link as 17/06/2025]

Mordor Intelligence, Mining Equipment Market (2024-2029), 2023.

Mordor Intelligence, Agricultural Machinery Market Size & Share Analysis - Growth Trends, Data & Forecasts (2025 - 2030) Source: https://www.mordorintelligence.com/industry-reports/agricultural-machinery-market, https://www.mordorintelligence.com/industry-reports/agricultural-machinery-market [Link as of 17/06]

Statistics Finland, Education and research, 2021, https://stat.fi/tup/suoluk/suoluk_koulutus_en.html(stat.fi)

Statistics Finland, International trade in goods and services, quarterly, 2013Q1-2025Q1, https://pxdata.stat.fi/PxWeb/pxweb/en/StatFin/StatFin__tpulk/statfin_tpulk_pxt_12gq.px/ [Link as of 19/06/2025]

S&P Capital IQ, Company Screening Report 2016-2024 [data as of 02/06/2025]
World Bank, Worldwide Governance Indicators, 2023, https://www.worldbank.org/en/publication/worldwide-governance-indicators [Link as of 13/06/2025]

United Nations Secretary-General's Special Advocate for Financial Health, Hello Tractor is Revolutionizing Farming and Fueling Economic Empowerment Through Digital Financing for Smallholders in Kenya, 2023, https://www.unsgsa.org/stories/hello-tractor-revolutionizing-farming-and-fueling-economic-empowerment-through-digital-financing-smallholders-kenya [Link as of 23/06/2025]

VTT Technical Research Center of Finland – SIX Sustainable Industry – Mobile Machines Cluster, Autonomy levels in mobile machine applications, by Josepha Berger, Risto Tiusanen, Johannes Hyrynen, 2025.

World Economic Forum, Fostering Effective Energy Transition 2024. Geneva: World Economic Forum, 2024, https://www.weforum.org/publications/fostering-effective-energy-transition-2024/ [Link as of 13/06/2025]

Power Systems Research (PSR), OELink, 2022.

Technology Industries
of Finland

Technology Industries of Finland | Eteläranta 10, P.O. Box. 10, 00130 Helsinki | Tel. +358 9 19 231 | techind.fi