



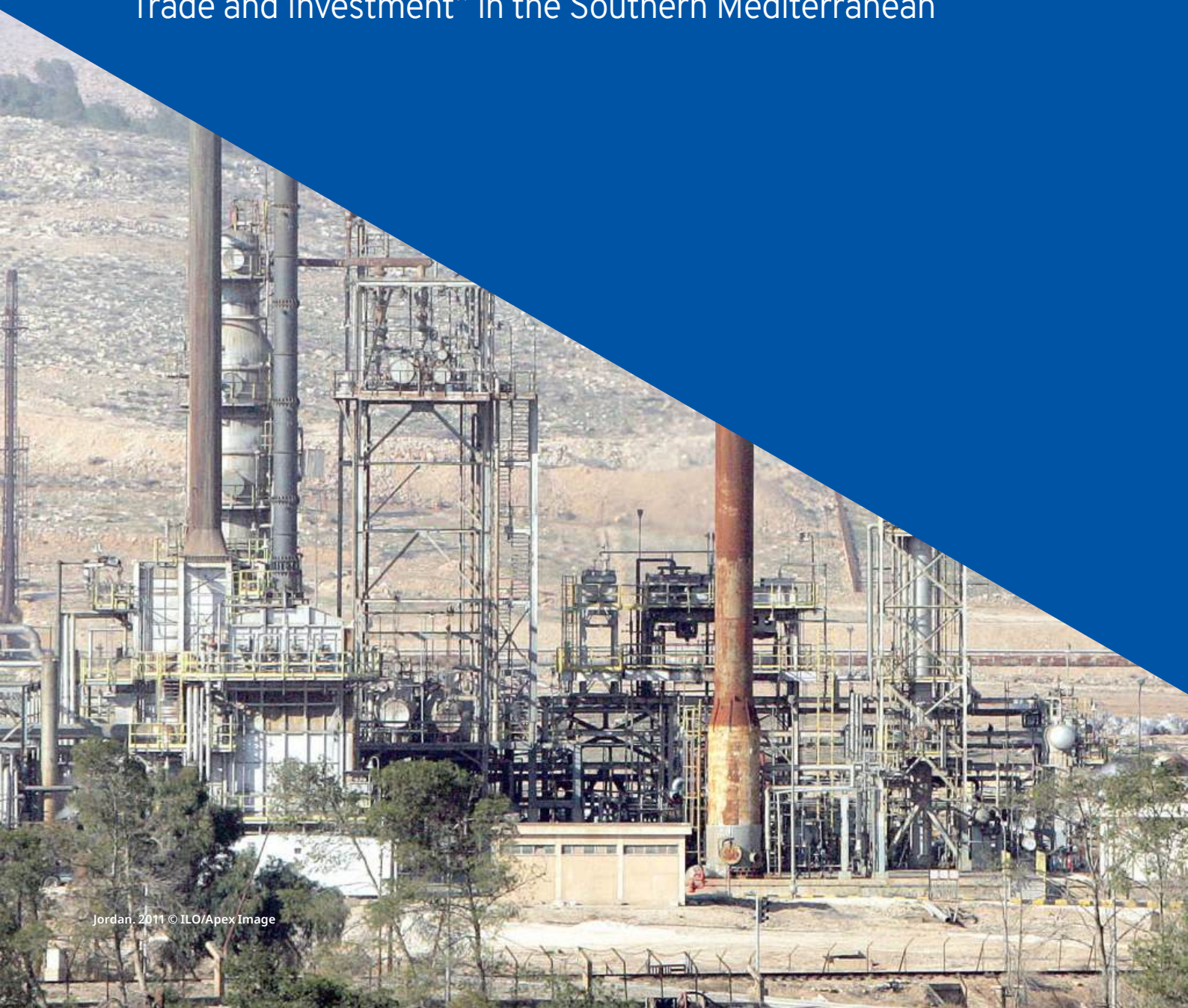
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► Skills for Trade and Economic Diversification (STED) Analysis of the Engineering Products and Services Sectors in Jordan

A study of the programme for “Mainstreaming Employment into Trade and Investment” in the Southern Mediterranean



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Southern Mediterranean

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► Table of abbreviations

EFTA	European Free Trade Association
EMRC	Energy and Minerals Regulatory Commission
ERP	Enterprise resource planning
GAFTA	Greater Arab Free Trade Area
ISIC	International Student Identity Card
HVAC	Heating, ventilation and air conditioning
JCI	Jordan Chamber of Industry
J-EUAA	Jordan-European Union Association Agreement
JSMO	Jordan Standards and Metrology Organization
JUST	Jordan University of Science and Technology
R&D	Research and development
SMEs	Small and medium-sized enterprises
STED	Skills for Trade and Economic Diversification
TVET	Technical and vocational education and training
US-JO FTA	Jordan-United States Free Trade Agreement
WTO	World Trade Organization

► Executive summary

The International Labour Organization (ILO) is implementing the programme entitled “[Mainstreaming Employment into Trade and Investment](#)” (METI) in the Southern Mediterranean, funded by the European Union. The overall objective of the **METI programme** is to enable policy makers in the Middle East and North Africa to incorporate employment issues into trade and investment policies, and to design and implement interventions that ultimately optimize the quantity and quality of employment created in the region. The value chain assessment carried out under the METI programme aims to identify bottlenecks and opportunities for expanding markets and exports in order to create more and better jobs. These will inform the support needed from governments and workers’ and employers’ organizations to enhance the sector’s competitiveness and exports, and to equip workers with the required skill sets.

The value chain assessment combines desk research, firm data collection and interviews with key informants. It also included a technical and policy foresight workshop (STED workshop) to support the development of sector-level skills governance arrangements, share the cooperation activities in the sector and engage participants in the key stages of diagnostics and planning on the skills needs for the target sector. The overall objective of the value chain assessment is to develop an implementation roadmap to support the sector in improving the capacity and competencies needed to enhance the sector’s competitiveness and realize its export potential. The assessment follows the ILO’s [Trade and Value Chains in Employment-Rich Activities](#) (TRAVERA) and [Skills for Trade and Economic Diversification](#) (STED) methodologies and draws on core elements of the ILO’s [Market Systems Approach to decent work](#). It combines all three approaches and the findings are reported in two separate reports, a STED and a TRAVERA report. This STED report provides an in-depth analysis of the engineering products and services sector in Jordan, focusing on its contributions to the economy, employment trends and workforce composition.

In 2021, the engineering products sector, which includes heating, ventilation, air conditioning, electric products, and construction materials, contributed to 5 per cent of the manufacturing sector’s gross domestic product (GDP). The sector’s export value was 0.2 billion Jordanian dinar, accounting for 14.1 per cent of manufacturing exports. Employing approximately 10,000 individuals, it represents 4.6 per cent of the manufacturing workforce. This sector benefits from a skilled engineering workforce and access to regional and international markets through free trade agreements, with a growing number of emerging companies supplying components to assembly firms (USAID, A/E Business Council and Jordan Exports, n.d.).

The engineering services sector comprises architectural and engineering services, including environmental engineering services, services supporting construction such as project management, planning and supervision, and air-conditioning services such as installation and maintenance. The engineering services sector contributes between 8 and 10 per cent to Jordan’s GDP. In 2022, the export value of construction services dropped to US\$68 million from US\$81 million in 2021. Jordan exports engineering services to over 31 countries, with the Gulf Cooperation Council countries and Iraq as key markets. In 2018, the sector employed 11,535 individuals, representing 1.4 per cent of total employment, and saw an 8 per cent increase in the number of registered companies from 2018 to 2022 (USAID, A/E Business Council and Jordan Exports, n.d.).

Employment trends in the engineering services sector show a consistent increase in the number of workers, with the manufacturing sector growing from 130,000 employees in 2019 to around 148,000 by 2021. In contrast, employment in the construction sector has been more stable, rising from 60,000 in 2019 to around 65,000 between 2021 and 2023 (USAID, A/E Business Council and Jordan Exports, n.d.).

A significant gender disparity exists in employment within the sector. In 2023, men constituted 84 per cent of the workforce, while women accounted for only 16 per cent. The disparity is particularly pronounced in engineering products, where only 9 per cent of the workforce is female compared to 36 per cent in consulting services. Additionally, participation of youth and women in the workforce is lower compared to that of men aged 25 and above, highlighting systemic challenges that hinder equitable workforce engagement.

► Engineering products sector

According to the STED workshop results, the analysis of **business capability gaps** within Jordan's engineering products sector highlights several critical areas requiring attention. A significant deficiency identified is the lack of a trusting and dialogue-based industrial relations culture, which hampers structured collaboration among industry stakeholders. Adherence to health and safety standards remains insufficient, impacting sustainability and worker well-being.

Additionally, there is a need for improved **financial and operational management practices** to address challenges related to efficiency, costs, and working capital requirements. Product innovation and improvement are essential for maintaining market competitiveness, and there is a pressing need for enhanced supplier management strategies to strengthen sourcing and supplier relationships. Furthermore, improvements in logistical planning and after-sales services are necessary to boost operational efficiency and customer satisfaction.

The engineering products sector faces significant **skills shortages** in specific occupations. Maintenance engineers and product development engineers are identified as key jobs with substantial skills gaps. Participants highlighted the shortage of qualified professionals in these roles, emphasizing a critical need for targeted training and development initiatives. In contrast, occupations such as warehouse operatives and industrial engineers were not seen as experiencing significant skills shortages, indicating a more stable talent supply in these areas.



Jordan. 2013 © Guillaume Megevand/ILO

Systematic constraints affecting the skills supply in the engineering products sector include:

- **Funding:** Insufficient funding for TVET colleges, universities, apprenticeships and workplace training limits the ability of institutions to offer programmes aligned with industry needs.
- **Relevance of curricula:** The relevance of the curriculum and qualifications provided is often misaligned with the demands of the sector, contributing to ongoing skills shortages.

According to the survey results, the occupational distribution in the engineering products sector shows a strong reliance on technical and trade skills, with technicians and associate professionals forming the largest group at 27 per cent, followed by craft and related trades workers at 24 per cent.

The technical and policy foresight workshop conducted in July 2024 discussed the engineering products sector in Jordan, which offers significant growth opportunities across national, regional and international markets. Nationally, the market is projected to grow by 60 per cent, driven by the adoption of energy-saving systems and the impact of climate change. Regional market expansion is supported by the Arab League Agreement, protective export laws and industry support programmes. International growth is fuelled by global trends in energy efficiency and climate change, with key markets including Egypt, the Kingdom of Saudi Arabia, Iraq and the United States.

Key challenges for the sector include financial constraints, particularly for raw material suppliers and aggregators, who face difficulties accessing investment and working capital. Logistical challenges, regulatory compliance issues and intense global competition—especially from technologically advanced markets such as China—also hinder growth. Despite these obstacles, Jordan's engineering products benefit from a strong reputation, competitive pricing and strategic geographic positioning.

Targeted interventions are necessary to unlock the sector's full potential. These should focus on improving access to finance, streamlining regulatory processes, and adopting advanced technologies such as 3D printing and automation. Compliance with international quality standards is essential for expanding into high-potential markets.

► Engineering services sector

In the engineering services sector, the STED workshop identified several **business capability gaps**. Firms struggle with implementing robust quality assurance and control systems that meet international standards, affecting the reliability of services. There is also a challenge in effectively integrating regulatory compliance into business operations, leading to delays and inefficiencies. The sector's engagement in sustainable development initiatives is limited, which impacts its social and environmental responsibilities.

Additionally, there is a need to establish a culture of trust and open communication within industrial relations. High costs and working capital requirements present further challenges, alongside issues with after-sales service and stakeholder communication. Developing a local supplier base and improving information technology systems and technology adaptation are crucial for enhancing operational effectiveness and sector growth.

Skills shortages and mismatches are prevalent in the sector, particularly for roles such as heating, ventilation and air conditioning (HVAC) design engineers, data analysts and research and development (R&D) engineers. While educational institutions offer a range of programmes, there is a gap between the skills produced and those required by the market, especially in emerging technologies. SMEs are particularly disadvantaged by limited access to specialized training, which hinders workforce development and competitiveness.

Key opportunities and challenges include the need to align education and training with industry demands through partnerships between academia and businesses. Addressing recruitment challenges—such as high turnover, limited diversity and competition for skilled talent—will be critical. Improving working conditions, offering competitive benefits and fostering sustainable practices within firms are necessary to enhance sector growth and ensure long-term competitiveness.

The future of Jordan's engineering products and services sectors depends on aligning skills development with evolving industry demands to foster economic diversification and enhance trade competitiveness.

Several policy implications arose from the STED workshop and survey findings, emphasizing the need for targeted interventions to address skills gaps and business capability deficits in both sectors.

In the engineering products sector, there is a pressing need to improve the technical competencies of junior industrial engineers. A structured training programme, led by senior engineers from leading factories, could bridge this skills gap by offering practical, hands-on experience. This initiative, overseen by industry associations such as the Jordan Engineers Association (JEA) and the Jordan Chamber of Industry (JCI), would also involve collaboration between large firms and SMEs, ensuring a more inclusive approach to skills development. Moreover, to stimulate innovation and R&D, tax incentives should be introduced. These incentives would support companies in enhancing their export competitiveness by encouraging investments in new technologies and processes. Another key area is warehouse operation, where formal training for SMEs is essential to improve operational efficiency and safety standards.

Similarly, the engineering services sector requires significant skills enhancements, particularly for laboratory technicians and HVAC design engineers. Establishing comprehensive training programmes, integrated with real-world applications, would improve both technical expertise and safety awareness. Universities, accredited laboratories, and industry associations should collaborate to deliver these programmes. Additionally, improving supply chain management skills, especially in export and import operations, is crucial for expanding market access and optimizing logistics. Training programmes focusing on these areas should be facilitated by the Jordanian Customs Department and other key industry stakeholders.

Both sectors would benefit from a broader strategy aimed at strengthening business capabilities. SMEs, in particular, require financial support to adopt advanced technologies and improve their technological competencies. Government-backed programmes could offer grants and loans to encourage the integration of information technology systems, automation and emerging technologies such as robotics and 3D printing. Additionally, improving management practices through targeted training in project management, leadership and strategic planning would empower SMEs to enhance their operational effectiveness. Mentorship programmes pairing SMEs with industry veterans could further support this effort.

Fostering a culture of innovation and R&D is also essential for long-term growth. Tax incentives and innovation grants could stimulate research partnerships between industry and academia, driving product development and technological advancements. Furthermore, promoting compliance with health and safety standards through dedicated training programmes would ensure safer working environments and regulatory adherence.

Cross-sectoral measures are equally important for sustaining growth. Strengthening supplier relationships through development programmes would enhance local supply chains, while promoting sustainability by introducing green technology grants and environmental standards would align Jordanian industries with global trends. Moreover, providing SMEs with access to market information and data analytics would enable them to make more informed business decisions and improve their competitiveness in international markets. Supporting market access by leveraging free trade agreements and assisting companies in meeting international standards would further facilitate trade expansion.

Lastly, raising awareness among businesses about customer engagement and market dynamics through networking opportunities and digital platforms is crucial. By fostering a deeper understanding of market demands, companies in Jordan's engineering sectors would be better positioned to expand their customer base and strengthen business relationships. Overall, these policy implications highlight the importance of a coordinated, multifaceted approach to addressing skills gaps and business capability deficits, ensuring sustainable growth and competitiveness in Jordan's engineering sectors.

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► About METI and STED

The ILO is implementing the programme “[Mainstreaming Employment into Trade and Investment](#)” (METI), funded by the European Union. The overall objective of the **METI programme** is to enable policymakers in the Middle East and North Africa to incorporate employment issues into trade and investment policies, and to design and implement interventions that ultimately optimize the quantity and quality of employment created in the region.

METI’s value chain assessment aims to identify bottlenecks and opportunities for expanding markets and exports to create more and better jobs. These will inform the support needed from governments and workers’ and employers’ organizations to enhance the sector’s competitiveness and exports, and to equip workers with the required skill sets.

The value chain assessment combines desk research, firm data collection and interviews with key informants. The aim of this analysis is to develop an implementation roadmap to support the sector in improving the capacity and competencies needed to enhance the sector’s competitiveness and realize its export potential.

The assessment follows the ILO’s TRAVERA and STED methodologies and draws on core elements of the ILO’s [Market Systems Approach to decent work](#). The assessment combines all three approaches, and the findings are reported in two separate reports: a STED report and a TRAVERA report.

- The **TRAVERA** report focuses on the employment content of different segments of the export value chain and provides an understanding of the different economic agents, their functional relations and their business environment. Moreover, the TRAVERA report identifies new opportunities for but also constraints to the expansion of production and exports of the respective sector. The final report provides guidance to stakeholders for the development of effective policy responses.
- The **STED** report builds on existing work by the ILO and other institutions on the national skills development and TVET system and focuses on the existing and emerging skills needs, skills gaps and occupations specific to the selected sector/value chain, as well as on the key systemic constraints of the skills supply side. The study addresses policy recommendations for stakeholders to help workers acquire the skills needed by exporting firms so that these firms can increase and diversify their export revenues.

The assessment involves a desk review, analysis of data from the TRAVERA-STED survey and structured interviews with key informants from relevant key stakeholders, including education and training providers, as well as national TVET authorities.



► Introduction

Jordan, located in the heart of the Middle East, is known for its rich human capital and strategic geopolitical significance. The demographic landscape of Jordan features a sizable and young population with distinct gender proportions. In the first quarter of 2024, Jordan's population stood at 11.5 million, with a growth rate of 2.2 per cent. Men constitute 53 per cent of the population, while women make up 47 per cent. Notably, Jordan has one of the youngest populations globally, with 63 per cent under the age of 30 and approximately one third within the 15–30 age range (Jordan, Department of Statistics 2024).

Jordan's labour market is characterized by a diverse range of industries, including services, manufacturing, agriculture and tourism. According to the latest data, the national unemployment rate reached 21.9 per cent of the labour force during the first quarter of 2023 (Jordan, Department of Statistics 2024), with a breakdown of 19.6 per cent for men and 30.7 per cent for women. The unemployment rate for youth aged 15–24¹ reached 46.1 per cent, highlighting ongoing challenges in the job market. Although the overall trend shows a decrease of 1 per cent from the preceding year and 3 per cent from 2021, unemployment rates for 2023 remain higher than the pre-COVID-19 period and have adverse effects on various sectors. The Government is actively working to address these challenges through various initiatives aimed at improving job creation, particularly for youth in the emerging sectors.

Jordan is an active participant in the global market, with a well-established trade network. The country's major exports include clothing, chemicals and potash, which significantly contribute to its GDP. Imports primarily consist of machinery and apparatus, crude petroleum and food products, supporting various sectors of the economy (Jordan Export Portal 2024). Trade

agreements with neighbouring countries and international partners, including the United States and the European Union, have bolstered Jordan's trade relations, enhancing economic growth and stability (ILO 2022). Despite the European Union being a significant trading partner for Jordan, it is not their preferred supplier, which results in a trade imbalance with higher exports than imports. The deficit in the trade balance, particularly the decline in manufactured goods exports, has negatively affected overall employment rates, even before the pandemic.

From 2010 to 2019, Jordan experienced slowed economic growth, with GDP maintaining a persistently low growth rate. Export rates stagnated following the global financial crises and Arab uprisings, and foreign direct investment also declined during this period. Recovery between 2012 and 2019 was slow and inconsistent, due to regional instability and a large influx of refugees. From 2017 to 2019, foreign direct investment inflows decreased significantly, falling from approximately 1.4 billion dinar to below 1 billion dinar. Net foreign direct investment inflows as a per centage of GDP dropped to pre-1999 levels of around 1.6 per cent (ILO 2023), likely due to the Government's budget consolidation measures, such as tax increases and subsidy cuts, in addition to regional geopolitical concerns. In 2020, the GDP growth rate turned negative, exports declined by 4.5 per cent and the unemployment rate rose by 4.1 per cent. Signs of recovery appeared in the second quarter of 2021, with trade increasing by 15 per cent and the unemployment rate decreasing by 1 per cent, though it remained above pre-COVID-19 levels. This positive trend persisted into the first quarter of 2023, with the GDP growth rate reaching 2.8 per cent (Jordan, Ministry of Planning and International Cooperation 2023). However, the Government's commitment to improving infrastructure, regulatory frameworks and the business environment continues to make Jordan an attractive destination for investors, driven by favourable government policies, a stable political climate and strategic economic reforms.

¹ This report uses the official definition of "youth" provided by the United Nations. See <https://www.un.org/esa/socdev/documents/youth/fact-sheets/youth-definition.pdf>. However, it should be noted that the study did not find any indication of workers below the age of 18 years.

The engineering sector in Jordan is the fourth largest in terms of total industrial exports, making it an attractive investment due to its high value-added potential. It plays a crucial role in the economy by supporting various other sectors through the provision of maintenance services, manufacture of spare parts, development of production lines and upgrading of production technology. In 2022, the number of establishments operating in the engineering industries sector registered with industrial chambers in Jordan was approximately 5,552. The registered workforce in the sector for 2022 was around 40,766 workers. The number of operating engineering offices was 1,291, with 50 new offices registered that year. By 2024, the number of active offices grew to 1,332, distributed across various categories and ranks, and the number of registered engineers reached 192,272 (Jordan, Companies and Engineering Offices Authority 2023).

STED is an ILO methodology designed to help partner countries meet the skills needs of key tradable sectors anticipated to drive economic and social development. The STED process is adaptable to the specific circumstances of each country and sector, as well as to the needs of project partners. Typically, the STED diagnostic process emphasizes primary research, including enterprise surveys, studies on the supply of skills, and extensive consultations with experts. It also involves background desk research based on available statistics and a review of relevant publications and documents. In order to conduct an in-depth analysis of industry profiles, skills demand, skills supply and skills mismatch in the engineering products and services sector in Jordan, this study adapted multiple research methods, comprising: (i) a combination of desk research and field research, utilizing a coordinated TRAVERA-STED approach; (ii) a questionnaire survey; and (iii) stakeholder consultation through the STED workshop (see **Annex I** for further details).

The engineering sector in Jordan employs a diverse workforce with varying education levels, predominantly technical and vocational. Despite 67 per cent holding diplomas or technical certifications and 23 per cent having bachelor's

degrees, there is a notable skills mismatch, with 42 per cent requiring further training, particularly in advanced manufacturing and digital skills. The sector faces high turnover, especially among technicians and junior engineers, due to unsatisfactory working conditions in SMEs² such as low salaries and lack of social security. Training investment varies, with large firms dedicating 5 per cent of their budgets to such training compared with 2.5 per cent for SMEs. Recruitment challenges are significant, with 48 per cent of firms struggling to find qualified candidates, particularly for technical roles. Technological and management capability gaps are prevalent, especially in SMEs, where 52 per cent cite outdated technology and 46 per cent need better management training. According to the survey results, only 28 per cent of firms have R&D departments, highlighting a lack of innovation. Employers report a 57 per cent shortage in automation and robotics skills in the product sector and a deficit in digital technology skills in the services sector, necessitating improved project management, strategic planning and essential soft skills.

This report provides an in-depth analysis of the engineering products and services sector in Jordan. It is structured into multiple sections to ensure a thorough examination and clear presentation of findings. The second section provides an overview of the engineering products and services sectors. It details the selection process for analysing the sectors, defines key terms, explains data collection sources and methodologies, and provides an in-depth analysis of the sectors, including value chains, employment and market trends. The subsequent sections cover the business environment, visions for the future, business capability gaps, the skills implications of business capability gaps, and the skills supply and mismatch. Based on the analysis, recommendations for responding to future skills needs are detailed in the section prior to the conclusion of the report.

² According to the Jordan Chamber of Industry, SMEs are defined as enterprises with fewer than 50 employees.





► Overview of the engineering products and services sectors

2.1 Sector selection process

In 2022, the METI project established a policy working group in Jordan to guide the project at the national level and to provide a space for social dialogue and cooperation. The working group is chaired by the Economic and Social Council of Jordan and comprises representatives from the following institutions:

- Business and Professional Women Association-Amman
- General Federation of Jordanian Trade Unions
- Jordan Chamber of Industry
- Jordan Enterprise Development Corporation
- Jordan Exports
- Jordanian National Commission for Women
- Ministry of Industry, Trade and Supply
- Ministry of Investment
- Ministry of Labour
- Ministry of Planning and International Cooperation
- Ministry of Public Works and Housing
- Ministry of Youth
- Phenix Center for Economics & Informatics Studies

One of the first tasks of the working group was to identify a priority export sector with the potential to create more and better jobs, in particular for women and youth, and in SMEs. Along with national priorities, the following selection criteria were defined:

- potential for upgrading in the value chain
- product complexity
- potential for diversification of export markets
- environmental sustainability
- working conditions
- probability of automation
- COVID-19 recovery
- crisis resilience

The METI team provided targeted analytical input alongside the identified selection criteria. Following several rounds of consultations, the working group decided by consensus to focus on the **engineering products and services sector**.

The **engineering products and services sector** encompasses **engineering, electrical and information technology industries** as well as **engineering services**. A comprehensive classification has been provided by the JCI based on the International Standard Industrial Classification (ISIC) system, with some adaptations to suit the national context. This classification has been carefully chosen by engineering experts in the JCI, based on thorough research and experience, and relies on international standards (mainly ISIC 4 and, in some cases, Harmonized System (HS) codes) for guidance.

2.2 Classification and subsectors

The classification by the JCI aligns closely with ISIC 4, ensuring international compatibility and comprehensiveness. The subsectors identified in the engineering products and services sectors are detailed below.

2.2.1 Engineering, electrical and information technology industries sectors

The table below outlines the subsectors of the engineering products sector as classified by the JCI, aligned with ISIC codes. This classification provides a structured overview of the sector's various components, with a specific focus on air conditioning, refrigeration, fire equipment and their supplies.

► **Table 1** Alignment between subsectors and ISIC codes

Alignment with ISIC code	Subsector
2410	Basic iron and steel articles
2420	Basic metal industries except iron and steel
2511/2829	Construction metal products, machinery, equipment, and tools for construction materials production
2593	Metal household tools and supplies, sharp and cutting tools
2592/2599	Sheet metal, casting, turning, wire, nails and screws
2750/2652	Electrical home appliances and accessories, including watches and alarm clocks
2520/2813	Central heating and solar heater work
2830	Metal devices and equipment for agricultural use
2710/2732/ 2740/2651	Electricals, lighting supplies, wires, electronic devices and weight measuring devices
2720	Compounds and primary cells
2610/2640	Information and communications technology device production, receivers, radio, television and recording devices
2910/2920	Vehicles, transportation equipment and supplies
7110	Drafting work
2822	Metal machines and tools
2813/2816	Pumps, winches, escalators and elevators
2825	Air conditioning, refrigeration, fire equipment and their supplies
2825	Equipment for preparing food and water

Source: United Nations, Department of Economic and Social Affairs (2008).

2.2.2 Engineering services

The engineering services classification was developed by the JEA, specifically the Companies and Engineering Offices Authority as follows:

- 1. environmental engineering**
- 2. engineering services supporting the construction sector**
3. mining
4. water and sewage
5. city and urban planning
6. traffic engineering and transport systems
7. project management
8. bridge engineering
9. structural engineering for high-rise buildings
10. road design and construction
11. power and electrical
12. mechanical engineering
13. surveying engineering
14. electronics engineering
15. architectural engineering
16. site surveying
17. material testing
18. structural engineering
19. interior design
20. management engineering

This report covers the following subsectors:

- engineering products: air conditioning, refrigeration, fire equipment and their supplies;
- engineering services: maintenance and installation services related to air conditioning, refrigeration, fire equipment and their supplies;
- engineering services: environmental engineering;
- engineering services: engineering services supporting the construction sector.

2.3 Sector profile

According to Department of Statistics in Jordan, employment trends in the sector show a consistent increase in the number of workers, with the manufacturing sector growing from 130,000 employees in 2019 to around 148,000 by 2021. In contrast, employment in the construction sector has been more stable, rising from 60,000 in 2019 to around 65,000 from 2021 to 2023 (Jordan, Department of Statistics 2023).

According to the results of surveys conducted in May 2024 for the purpose of this report, a significant gender disparity exists in employment within the sector. In 2023, men constituted 84 per cent of the workforce, while women accounted for only 16 per cent. The disparity is particularly pronounced in engineering products, where only 9 per cent of the workforce is female compared to 36 per cent in consulting services. Additionally, the participation of youth and women in the workforce is lower compared to that of men aged 25 and above, highlighting systemic challenges that hinder equitable workforce engagement.

The occupational distribution in the engineering products sector shows a strong reliance on technical and trade skills, with technicians and associate professionals forming the largest group at 27 per cent, followed by craft and related trades workers at 24 per cent. In engineering services, technical and associate professionals constitute the largest segment at 36 per cent, with craft and related trades workers at 16 per cent. This underscores the sector's dependency on specialized technical expertise and practical skills.

Vocational training centres and schools play a crucial role in developing a skilled workforce. However, such establishments struggle to meet market demand due to systemic constraints such as outdated curricula and inadequate engagement with industry experts. Participants emphasized the need for partnerships between industry and educational institutions to ensure training programmes are relevant to current market requirements. To address future skills needs, participants proposed initiatives such as developing training programmes for warehouse operators, enhancing technical skills for industrial engineers and promoting R&D through tax incentives. Additionally, in the engineering services sector, proposals included improving data analyst training, enhancing supply chain management skills and offering scholarships for machine learning and artificial intelligence programmes. These initiatives aim to align skills supply with market demand, ultimately fostering a more competent workforce prepared for future challenges.

2.3.1 Engineering products

In 2021, the engineering products sector in Jordan contributed 199 million dinar to the country's GDP, representing 5 per cent of the total manufacturing GDP. Its exports account for 14.1 per cent of manufacturing exports. The sector provides employment for approximately 10,000 individuals, representing 4.6 per cent of total employment within the manufacturing sector. The industry benefits from an abundance of skilled engineers and access to regional and international markets through free trade agreements. According to Jordan's Economic Modernisation Vision, the sector is characterized by a growing number of emerging companies that supply components to assembly firms, reflecting its development and potential for expansion (Jordan, Ministry of Planning and International Cooperation, n.d.).

The engineering products sector in Jordan exhibits substantial potential for growth, particularly in the air-conditioning market. Nationally, market expansion is driven by the adoption of energy-saving and alternative energy systems, the use of air conditioning for heating and the effects of climate change. Regionally, the growth trend is reinforced by climate change, the Arab League Agreement, and laws

protecting exports, as well as programmes supporting industry and exports. Internationally, similar factors, including climate change, trade agreements and industry support programmes, contribute to a positive growth outlook.

In the engineering products sector, there are large domestic firms that produce air conditioners such as Petra Engineering Industries Co. and National Refrigeration Co. These are the most well-known air-conditioning firms in Jordan and are owned by Jordanian investors. Other firms are assemblers or aggregators that import inputs and other parts from different countries, and then sell air conditioners locally in Jordan or export them.

Competition in the national market is marked by high demand and opportunities, with the market being far from saturated. In contrast, the regional market faces challenges in competition, despite the good reputation of Jordanian products. On the international stage, Jordanian products are recognized for meeting international standards, though competition remains fierce in key markets such as Iraq, the Kingdom of Saudi Arabia, the United Arab Emirates and the United States.

Jordan's comparative advantages in the national market include flexibility in productivity, rapid technological adaptation and competitive pricing relative to quality. Regionally, these advantages are complemented by geographic proximity and a strong product reputation. Internationally, Jordan benefits from geographic advantages and free trade agreements that facilitate stronger trade ties.

In terms of product and service evolution, the national market is witnessing a shift towards alternative and environmentally friendly systems. Regionally, the focus is on integrating artificial intelligence and technology with local products. Internationally, the emphasis is on aligning products with market demands and ensuring compliance with international standards.

The routes to market for the national sector include trade shows and both digital and traditional marketing. Regionally, trade is facilitated through the Arab League Agreement, commercial exchanges and trade delegations. Internationally, free trade agreements and participation in international exhibitions play a significant role, alongside market studies that inform strategic decisions.

Key occupations identified as critical for the engineering products sector include maintenance engineers, warehouse operators, product development engineers, industrial engineers, supply chain analysts, skilled operators and assemblers, quality control engineers and sustainability coordinators. These roles are essential for driving innovation, efficiency and sustainability within the sector. Despite the high number of engineering graduates in Jordan, particularly industrial engineers, there is a noted gap in relevant skills, highlighting the need for education systems to align curricula with market needs.

2.3.2 Engineering services

The engineering services sector, which includes architectural and engineering services, contributes between 8 and 10 per cent to Jordan's GDP. In 2022, Jordan's construction service exports amounted to US\$68 million, a decrease from US\$81 million in 2021. The country exports engineering services to over 31 nations, with the Gulf Cooperation Council countries and Iraq being key markets. In 2018, there were 11,535 employees in the engineering services sector, representing 1.4 per cent of total employment according to the Department of Statistics. The sector benefits from a skilled engineering workforce and has experienced growth, with the number of registered engineering companies increasing by 8 per cent between 2018 and 2022 (USAID, A/E Business Council and Jordan Exports, n.d.).

The engineering services sector in Jordan is poised for growth, with national efforts focused on developing new strategies and assessing market needs. Regionally, the sector's growth is supported by

regulatory frameworks, innovation and the application of new technologies. At the international level, accessibility, globalization and continued innovation drive the sector's expansion.

Ownership of the engineering services category is entirely Jordanian, with national companies constituting 70 per cent of environmental services firms. Regarding the export activities of these companies, almost all are local firms that implement projects in Jordan or even export their services to regional and, sometimes, international markets. Their role is mainly to provide the support needed for construction projects, such as project planning, design and supervision. They also provide environmental services such as the provision of environmental assessments and consulting, the conduct of environmental impact studies and analyses, and the development of environmental management systems.

Competition within the national market is influenced by efforts to reduce service costs and enhance quality through capacity building in education. The diversity of service providers also contributes to improved service quality and reduced costs. Regionally and internationally, competition is enhanced by collaboration and aggregation, with a focus on reducing export taxes to maintain competitive pricing.

The sector's comparative advantages nationally include a strong education system, low wages combined with a high-quality workforce and skilled human resources. Regionally, these advantages are mirrored, with an additional emphasis on the quality of education. Internationally, Jordan's geographic location and updated international agreements enhance its competitive edge.

In response to changing market demands, the sector is increasingly adopting eco-services, recycling initiatives and cost-effective strategies at the national level. Regionally, resilience, risk management planning and certification processes are being prioritized. Internationally, the focus is on adherence to international standards and robust risk management practices.

Routes to market for the engineering services sector include field visits, networking conferences and regional trade agreements on the national and regional levels. Internationally, trade treaties and agreements facilitate market access and growth.

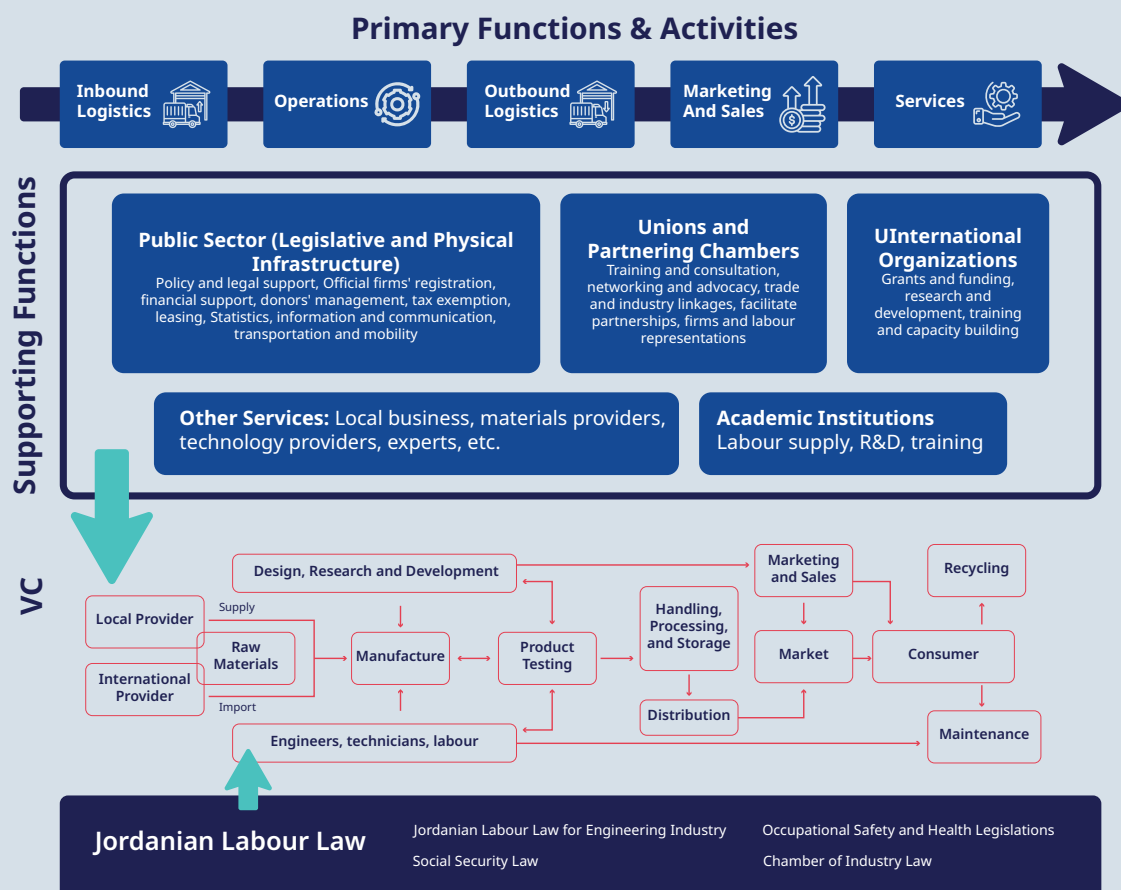
Key occupations essential for the engineering services sector include data analysts, supply chain managers, R&D engineers, environmental health and safety managers and sustainability coordinators. These roles are critical for driving informed decision-making, optimizing supply chains, fostering innovation, ensuring compliance with safety standards and promoting sustainability. The sector faces challenges in aligning education and skills development with these occupational needs, indicating that enhanced training and practical experience are required to meet future demands.

2.4 Value chains

The engineering products and services sector in Jordan encompasses a variety of activities, including manufacturing, assembly, distribution, services related to air conditioning, refrigeration and fire equipment, and broader engineering services. This subsection delves into the functions of the value chain, identifying key stakeholders and highlighting the roles they play at different stages.

2.4.1 Engineering products sector

► Figure 1 Value chain – engineering products sector



Note: VC = value chain.

Source: Authors' compilation.

2.4.1.1 Stakeholders and overall functioning

Figure 1 above illustrates the various stakeholders and the overall functioning of the engineering products sector:

- The public sector provides critical legislative and physical infrastructure, encompassing policy and legal support, financial assistance, tax exemptions, the management of donors and official firm registration. This sector also ensures essential services such as transportation, communication and statistical information that support the industry's operational needs.
- Unions and partnering chambers play a pivotal role in facilitating the sector's growth by offering training, consultation and advocacy. These entities connect trade and industry, fostering partnerships and representing the interests of both firms and labour.
- International organizations contribute significantly through grants, funding and R&D initiatives. They also provide training and capacity building, which are crucial for enhancing the sector's capabilities and global competitiveness.

- The chain further includes other services, such as local businesses, material and technology providers and academic institutions, which supply labour, R&D and specialized training. The supply chain itself begins with raw materials, either sourced locally or imported, followed by design, research and development phases.
- Manufacturing is at the core of the value chain, supported by engineers, technicians and labour. After production, products undergo testing and are processed, handled and stored before being distributed and marketed. The final stages involve reaching the consumer, with considerations for maintenance and recycling to ensure sustainability.
- Legal frameworks such as the Jordanian Labour Law, specific laws for the engineering industry, the Social Security Law, the Chamber of Industry Law, and occupational safety and health legislation, provide the regulatory backbone that governs and ensures compliance across the value chain.

2.4.1.2 Segments of the value chain

The value chain for engineering products in Jordan is complex and involves multiple stages, each critical to the successful production and distribution of these products. Understanding the key stakeholders, their roles, and the constraints they face is essential for developing strategies to enhance the sector's competitiveness. Table 2 provides further details on the individual segments of the value chain, and links them to the survey findings.

► **Table 2** Air conditioning, refrigeration, fire equipment and their supplies

Function	Overview	Key stakeholders	Role
Raw material supply	The initial stage of the value chain involves sourcing raw materials and inputs essential for manufacturing engineering products.	Local providers and international suppliers	Material procurement specialists, quality inspectors and supply chain coordinators are responsible for ensuring the quality and timely delivery of raw materials.
Processing	This stage involves processing raw materials into intermediate goods that can be used in further manufacturing or directly in engineering services.	Local processors and aggregators	Processing technicians, production supervisors, industrial engineers and maintenance engineers
Aggregation	Aggregators collect and organize processed materials for further manufacturing or distribution.	Logistics coordinators, inventory managers and warehouse operatives	Logistics coordinators, inventory managers and warehouse operatives
Manufacturing	Manufacturers convert processed materials into final engineering products.	Local large firms, and micro, small and medium-sized enterprises (MSMEs)	Manufacturing engineers, assembly line workers, product development engineers and production planners
Distribution	Distribution involves delivering finished products to wholesalers, retailers or directly to customers.	Large local firms and MSMEs	Distributors, freight forwarders and logistics managers
Sales/retail	This stage focuses on the marketing and selling of engineering products to end users.	MSMEs	Sales representatives, retail managers and customer service agents
Installation and maintenance	This stage involves the installation and ongoing maintenance of engineering products.	Local MSMEs and informal workers	Installation technicians, maintenance engineers and service contractors
Regulatory compliance and certification	This stage ensures compliance with industry standards and regulations.	Jordan Standards and Metrology Organization (JSMO) and government bodies	Regulatory officers, quality assurance managers and certification specialists.

Source: Authors' compilation.

Raw material supply

The value chain begins with the sourcing of raw materials, a stage that is vital for the entire production process. Both local providers and international suppliers play a crucial role here, with material procurement specialists and quality inspectors ensuring that the inputs meet required standards. According to the survey of firms, 48 per cent of SMEs are aggregators, and 14 per cent are raw material suppliers, which underscores the significance of this stage. However, constraints such as dependency on imported materials and potential delays in supply chains pose risks to the continuity and efficiency of the production process.

► Processing

The next stage involves processing raw materials into intermediate goods. Local processors, which are primarily SMEs, employ a significant portion of the workforce, including processing technicians and production supervisors. The survey revealed that 35 per cent of firms are involved in processing, with 60 per cent of these categorized as SMEs. A major challenge at this stage is maintaining efficiency and quality amidst resource constraints and the need for skilled labour.

► Aggregation

Aggregators play a pivotal role in collecting and organizing processed materials, making them available for further manufacturing or distribution. Given that 48 per cent of SMEs serve as aggregators, their role in managing logistics and inventory is critical. However, logistical challenges, such as inadequate infrastructure and inefficient inventory management systems, often hinder smooth operations, affecting the flow of materials through the value chain.

► Manufacturing

Manufacturing is at the heart of the value chain, where processed materials are converted into final engineering products. This stage is dominated by large firms such as Petra Engineering Industries Co. and National Refrigeration Co., particularly in the production of air conditioners. However, SMEs also play a significant role in assembly and component manufacturing. Key challenges include the need for technological upgrades, better production planning, and addressing gaps in workforce skills to keep pace with international standards.

► Distribution

The distribution stage involves the delivery of finished products to the market. While large firms with robust logistics networks dominate this stage, approximately 60 per cent of surveyed firms reported facing logistical challenges. These include poor infrastructure, high transportation costs and inefficiencies in the distribution network, which collectively constrain market reach and product availability.

► Sales and retail

Sales and retail functions are essential for bringing engineering products to end users. MSMEs are heavily involved in this stage, with sales representatives, retail managers and customer service agents playing key roles. However, the integration of sales with other value chain activities remains weak, with only 17 per cent of firms identifying themselves as involved in both raw materials supply and retail. Enhancing sales and marketing strategies is crucial for business growth, particularly for tapping into new markets.

► Installation and maintenance

Installation and maintenance are crucial post-sale services that ensure the long-term functionality of engineering products. A significant portion of this work is handled by MSMEs, with 45 per cent of firms involved in these services. However, the high percentage (30 per cent) of informal workers in this stage poses a challenge. Formalizing these roles is necessary to improve quality standards, ensure regulatory compliance and enhance the overall reliability of services.

► Regulatory compliance and certification

Finally, regulatory compliance and certification are essential for maintaining industry standards and accessing export markets. The JSMO and other government bodies are key stakeholders here. The firms surveyed emphasized the importance of certifications such as the European Conformity (CE) marking and ISO standards. However, obtaining these certifications can be a constraint, particularly for SMEs, due to the costs and complexities involved.

2.4.1.3 Constraints in the product sector: Air conditioning, refrigeration and fire equipment

1. Raw material and input procurement

- **Supply chain dependency:** The engineering product sector in Jordan is highly dependent on imported raw materials, particularly from countries such as China. This dependency makes the sector vulnerable to supply chain disruptions, which can significantly impact production timelines and costs. The reliance on a few key suppliers limits the ability to negotiate better terms or find alternative sources when disruptions occur, leading to delays and increased costs.
- **High and volatile import costs:** The sector faces substantial challenges due to the high and often volatile costs associated with importing raw materials and components. Fluctuations in import prices, combined with high tariffs, directly impact profit margins, making it difficult for firms to maintain competitive pricing. This volatility complicates budgeting and financial planning, further straining the financial resources of businesses within the sector.
- **Dependency on specific suppliers:** The heavy reliance on a limited number of suppliers for critical components increases the sector's vulnerability. When disruptions occur, firms have few alternatives to turn to, which can halt production or increase costs as they scramble to secure necessary materials. This dependency limits flexibility and can be a significant bottleneck in the production process.

2. Manufacturing and assembly

- **Technological obsolescence:** Many manufacturing firms, especially SMEs, operate with outdated machinery and equipment. This technological lag hampers production efficiency and quality, limiting the ability of these firms to compete effectively in both local and international markets. The lack of investment in modern technology reduces the sector's overall productivity and ability to innovate.
- **Skilled labour shortage:** There is a notable shortage of skilled workers in manufacturing and assembly processes. This gap in skilled labour affects the sector's ability to adopt and implement advanced manufacturing techniques, reducing overall productivity and innovation capacity. The shortage also places a strain on existing workers, leading to increased workloads and potentially higher error rates.
- **Energy costs:** High energy costs in Jordan are a significant burden on manufacturing firms, particularly those involved in energy-intensive processes such as air conditioning and refrigeration. These costs add to the overall expense of production, making it more difficult for firms to offer competitive pricing, especially in markets where energy is cheaper.
- **Quality control issues:** Maintaining consistent product quality is a persistent challenge due to outdated manufacturing processes. Inconsistent quality can lead to product defects, customer dissatisfaction and a tarnished reputation, all of which can harm a firm's ability to secure repeat business and expand its market presence.

3. Distribution

- **Logistical inefficiencies:** Inefficiencies in logistics, such as inadequate infrastructure and high transportation costs, are significant challenges. These inefficiencies can lead to delays in product delivery, increased costs, and reduced competitiveness in both domestic and international markets. Poor logistics can also complicate the ability to scale operations efficiently.
- **Limited market access:** Firms face considerable challenges in accessing new markets due to a lack of robust distribution networks and partnerships. This limitation hinders growth potential, particularly in expanding into lucrative markets such as the Gulf Cooperation Council countries. Without strong distribution channels, firms struggle to reach new customers and increase sales volumes.
- **High distribution costs:** The high cost of distribution within Jordan, exacerbated by geographical and infrastructural challenges, further constrains the ability of firms to compete. These costs add to the final price of products, making them less competitive compared to imports that benefit from more efficient supply chains.

4. Installation and maintenance

- **Informal workforce:** A significant portion of installation and maintenance work is carried out by informal workers, leading to challenges in maintaining quality standards and compliance. The use of untrained or inadequately trained personnel results in inconsistent service delivery, which can damage a firm's reputation and lead to increased costs due to rework and customer dissatisfaction.
- **Lack of standardization in services:** The absence of standardized practices in installation and maintenance results in varying service quality across the sector. This inconsistency can erode customer trust and make it difficult for firms to establish a strong market presence, as customers may be hesitant to rely on services that vary widely in quality.
- **Underdeveloped after-sales support:** After-sales services, including maintenance and warranty support, are often underdeveloped. This lack of focus on after-sales care negatively impacts customer retention and brand loyalty, as customers may feel neglected after the initial sale, leading them to seek out competitors who offer better support.

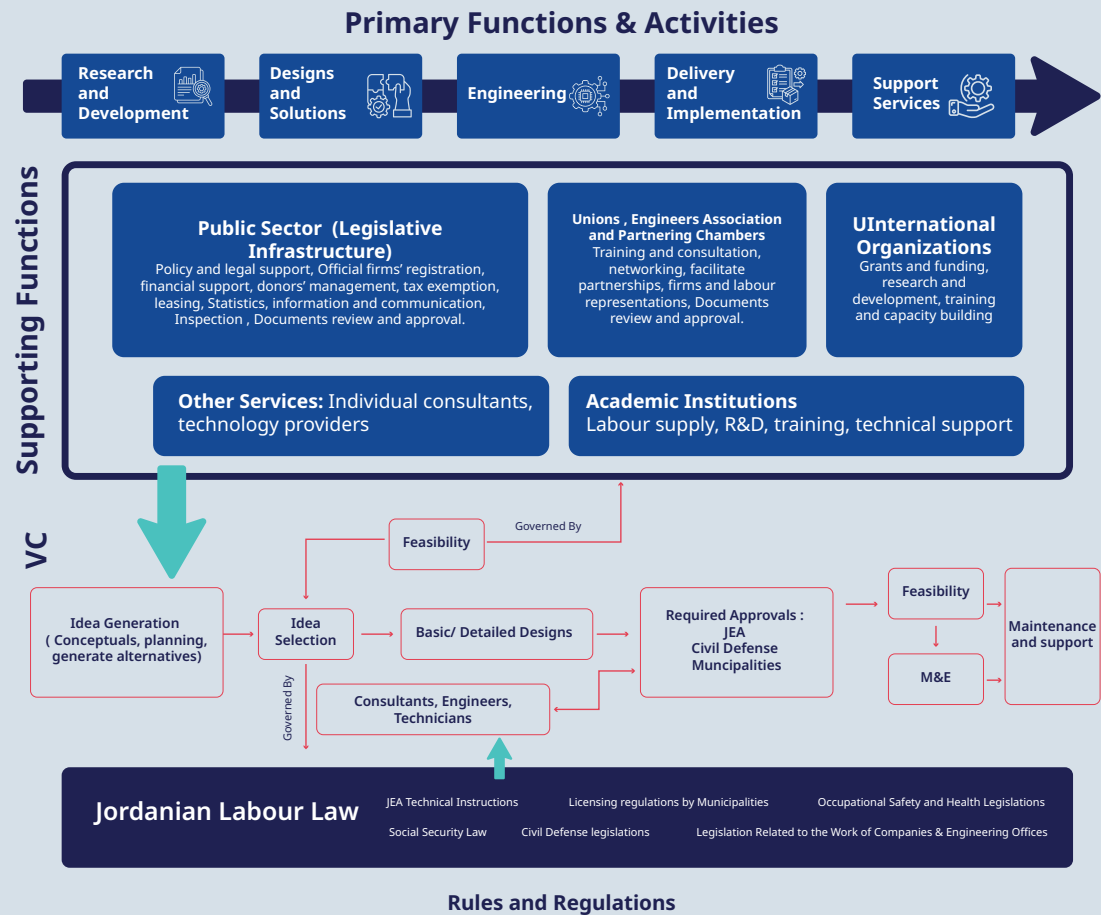
5. Regulatory compliance and certification

- **Compliance costs:** Meeting international certification standards, such as CE marking and certification by the Saudi Standards, Metrology and Quality Organization (SASO), is both costly and complex. The financial burden of compliance limits the ability of firms to compete in high-demand markets, such as the Gulf Cooperation Council countries. The complexity of these standards also requires firms to invest in specialized knowledge and resources, further straining their budgets.

- **Inconsistent enforcement:** Firms report inconsistencies in the enforcement of local regulations, creating an uneven playing field. This inconsistency can lead to some firms gaining an unfair advantage by cutting corners, while others who adhere strictly to the rules may find themselves at a competitive disadvantage.
- **Bureaucratic delays:** Firms often face significant delays in obtaining necessary certification and regulatory approvals due to bureaucratic inefficiencies. These delays can prevent firms from bringing products to market in a timely manner, impacting revenue and market share as they miss out on key selling opportunities.

2.4.2 Engineering services sector

► Figure 2 Value chain - Engineering services sector



Note: VC= value chain, M&E= monitoring and evaluation.

Source: Authors' compilation

2.4.2.1 Stakeholders and overall functioning

Figure 2 illustrates the various stakeholders and the overall functioning of the engineering services sector value chain.

- The public sector provides essential legislative infrastructure. This includes policy and legal support, official firm registration, financial assistance, donor management, tax exemptions and leasing. The public sector also plays a crucial role in inspections, and document reviews and approvals, ensuring compliance and facilitating smooth operations.
- Unions, engineers associations and partnering chambers are integral to the sector, offering training, consultation and networking opportunities. They help forge partnerships, represent firms and labour, and assist in the review and approval of essential documents, thereby streamlining the regulatory processes.
- International organizations contribute through grants, funding and capacity-building initiatives, alongside R&D efforts. They also provide specialized training, enhancing the sector's global competencies. Additional support is provided by other services such as individual consultants and technology providers, alongside academic institutions, which supply labour, conduct R&D and offer technical support and training.
- The value chain itself starts with idea generation, encompassing conceptual planning and the exploration of alternatives. This phase is governed by Jordanian labour laws and technical instructions provided by the JEA and licensing regulations by municipalities.
- Once ideas are generated, the idea selection process follows, which involves evaluating feasibility, conducting basic and detailed designs, and engaging consultants, engineers and technicians. At this stage, approvals are required from the JEA, the Civil Defence and municipalities to ensure that all designs meet regulatory and safety standards.
- Finally, the chain concludes with implementation and maintenance, where projects are brought to life. This stage includes ongoing monitoring, evaluation and support to ensure the project's longevity and effectiveness, guided by established maintenance protocols. This comprehensive approach ensures that every engineering service is delivered efficiently, sustainably and in compliance with all regulatory requirements.

2.4.2.2 Segments of the value chain

Table 3 provides further details on the individual segments of the value chain, and links them to the survey findings.

► **Table 3** Environmental engineering and engineering services supporting the construction sector

Function	Overview	Key stakeholders	Role
R&D	Focuses on conceptual planning and generating alternatives	Large local and foreign-investor firms and international non-governmental organizations	R&D engineers, project planners and innovation managers
Designs and solutions	Involves creating detailed designs based on selected ideas	Large local and foreign-investor firms	Design engineers, solution architects and technical consultants
Project implementation	Covers the actual implementation of engineering services projects	Large local firms	Consultants, engineers and technicians
Support services	Post-implementation maintenance and support services	Local MSMEs	Maintenance engineers, support technicians and service managers
Quality assurance and compliance	Ensures that projects meet regulatory standards	Government bodies, municipalities and MSMEs	Quality assurance managers, compliance officers and inspectors
Environmental impact assessment and consulting	Focuses on environmental evaluation and sustainability consulting	Large local firms and MSMEs	Environmental engineers, sustainability consultants and impact analysts

Source: Authors' compilation

► **Overview of the engineering services value chain in Jordan**

The engineering services sector in Jordan encompasses a wide range of activities that are essential for the successful completion of engineering projects. Each function in the value chain plays a critical role, from the initial R&D phase to post-implementation support. Understanding the key stakeholders, their roles, and the challenges they face provides valuable insights into the sector's strengths and areas for improvement.

► **R&D**

The value chain begins with R&D, which is crucial for conceptual planning and generating innovative alternatives. This stage is dominated by large local firms, foreign investors and international non-governmental organizations. R&D engineers, project planners and innovation managers are central to this function. Investment in R&D is essential for innovation, and leading firms are integrating advanced technologies to stay competitive. However, constraints such as limited funding and the need for continuous skill development can hinder innovation.

► Designs and solutions

Following R&D, the focus shifts to creating detailed designs based on selected ideas. Large local and foreign-investor firms typically handle this function, employing design engineers, solution architects and technical consultants. The sector has reported a significant demand for advanced design skills, with 35.3 per cent of firms identifying engineering design as a critical area of expertise. Constraints in this stage include the need for upskilling and the adoption of cutting-edge design tools to keep pace with global standards.

► Project implementation

Project implementation is the key stage at which engineering services are executed. Large local firms lead in this area, with consultants, engineers and technicians playing pivotal roles. Jordanian firms excel in implementation, with 33.3 per cent of surveyed firms exporting their engineering services, particularly in project management and structural engineering. However, challenges such as managing project timelines, controlling costs and ensuring the availability of skilled labour can impact the efficiency and success of this function.

► Support services

After project completion, support services become crucial for ensuring the longevity and performance of engineering projects. This stage is predominantly managed by local MSMEs. Maintenance engineers, support technicians and service managers are essential in providing these services. The quality of support services directly affects client satisfaction and long-term business relationships. Firms have emphasized the need for enhanced training in maintenance practices and customer service to address gaps in this area.

► Quality assurance and compliance

Quality assurance and compliance ensure that engineering projects meet both national and international regulatory standards. This function involves government bodies, municipalities and MSMEs, with roles such as quality assurance managers, compliance officers and inspectors. Adherence to quality and safety standards is non-negotiable, especially for firms aiming to compete in international markets. However, the process of obtaining necessary certifications can be challenging, particularly for smaller firms that may lack the resources to navigate complex regulatory environments.

► Environmental impact assessment and consulting

The final stage of the value chain focuses on environmental impact assessment and consulting. This area has increasingly gained importance as firms and clients alike prioritize sustainability. Large local firms and MSMEs provide these services, with environmental engineers, sustainability consultants and impact analysts leading the way. The growing emphasis on sustainability presents significant opportunities for firms that specialize in environmental consulting and impact assessments. However, firms may face constraints such as the need for specialized expertise and the integration of sustainability practices into traditional engineering services.

2.4.2.3 Constraints in the service sector: Environmental engineering and engineering services supporting construction

1. R&D

- **Underinvestment in R&D:** The service sector struggles with low investment in R&D, which hampers innovation and the development of new services. Without dedicated resources for R&D, firms find it challenging to stay competitive and offer cutting-edge solutions. This underinvestment limits the sector's ability to respond to changing market demands and technological advancements.
- **Limited collaboration:** A lack of collaboration between academia and industry in R&D activities stifles innovation. Without strong partnerships with research institutions, firms miss out on opportunities to develop new technologies and methodologies that could improve their service offerings and competitive edge.
- **Lack of funding for innovation:** Beyond underinvestment, there is a critical shortage of funding specifically allocated for innovation in the service sector. This lack of financial support stifles the development of new services and technologies that could set firms apart from their competitors.
- **Slow technology adoption:** Firms are often slow to adopt emerging technologies, particularly in areas such as digitalization and smart infrastructure. This hesitation is due to both cost concerns and a lack of trained personnel, which limits the sector's ability to stay competitive and deliver state-of-the-art services.

2. Design and solutions

- **Technological gaps:** Firms in the service sector face challenges in adopting advanced design tools and software, which are crucial for delivering high-quality engineering solutions. The inability to integrate these technologies into their design processes affects both the efficiency and quality of the services they provide.
- **Skilled workforce shortage:** There is a notable shortage of skilled designers and engineers, which limits the sector's ability to develop innovative and competitive solutions. This skills gap is particularly problematic in emerging fields such as sustainable design and smart technologies, where expertise is critical for success.
- **Regulatory complexity:** The complex and often changing regulations regarding environmental and construction standards create significant barriers for firms during the design phase. Keeping up with these regulatory changes is challenging, especially for firms involved in international projects where multiple regulatory frameworks must be navigated.
- **Intellectual property protection issues:** Concerns about intellectual property protection for proprietary designs and solutions are significant. Weak intellectual property enforcement in Jordan discourages investment in innovative designs, limiting the ability of firms to differentiate themselves in the market.

3. Project implementation

- **Project management challenges:** Effective project management is a significant challenge, especially in large-scale construction projects. Inefficiencies in managing resources, timelines and client expectations can lead to project delays and cost overruns, which are detrimental to a firm's reputation and profitability.
- **Regulatory compliance:** Ensuring compliance with local and international standards during project implementation is a major constraint. Navigating the regulatory requirements, particularly for projects involving environmental impact assessments and sustainability certifications, is complex and resource-intensive.
- **Shortage of experienced project managers:** There is a critical shortage of experienced project managers capable of handling large-scale and complex projects. This gap leads to inefficiencies and higher risks of project delays and budget overruns, which can severely impact a firm's ability to deliver projects on time and within budget.

4. Quality assurance and compliance

- **Inadequate quality control:** The sector struggles with maintaining consistent quality standards across projects. Gaps in quality assurance processes can lead to client dissatisfaction and negatively impact a firm's reputation, making it difficult to secure repeat business.
- **High compliance costs:** Meeting stringent quality and safety standards, particularly in international markets, is costly. The financial burden of compliance limits the ability of firms to compete in high-demand markets, as they may not have the resources to meet these rigorous standards.
- **Fragmented quality standards:** The lack of a unified set of quality standards across the service sector results in varying levels of compliance and quality. This fragmentation makes it difficult for firms to maintain consistent service quality, particularly in multi-firm projects where coordination and standardization are key.

5. Environmental impact assessment and consulting

- **Limited expertise:** There is a shortage of professionals with expertise in environmental impact assessments, particularly for complex and large-scale projects. This gap affects the ability of firms to secure contracts for environmentally sensitive projects, as clients may seek out more experienced providers.
- **Regulatory challenges:** Navigating the complex regulatory landscape for environmental compliance is a significant constraint. The difficulties in obtaining necessary approvals and certification can lead to project delays and increased costs, making it challenging for firms to deliver projects on time and within budget.
- **Inadequate local expertise:** There is a shortage of local experts trained in environmental impact assessments and sustainability consulting. This gap limits the ability of local firms to compete with international firms.
- **Client resistance to environmental standards:** In the construction sector, many clients are reluctant to adopt stringent environmental standards, viewing them as costly and overly complex. This resistance poses a significant challenge for firms striving to implement sustainable practices. The reluctance of clients to embrace eco-friendly standards hinders the ability of service providers to deliver competitive, environmentally sustainable solutions, ultimately limiting their market appeal and effectiveness in promoting green practices.

2.5 Patterns and trends in trade

The following subsection explores trade patterns and trends within the region, in the European Union and globally, including the evolution of exports, product and market diversification, and top exporters and importers in the sector.

2.5.1 Engineering products sector

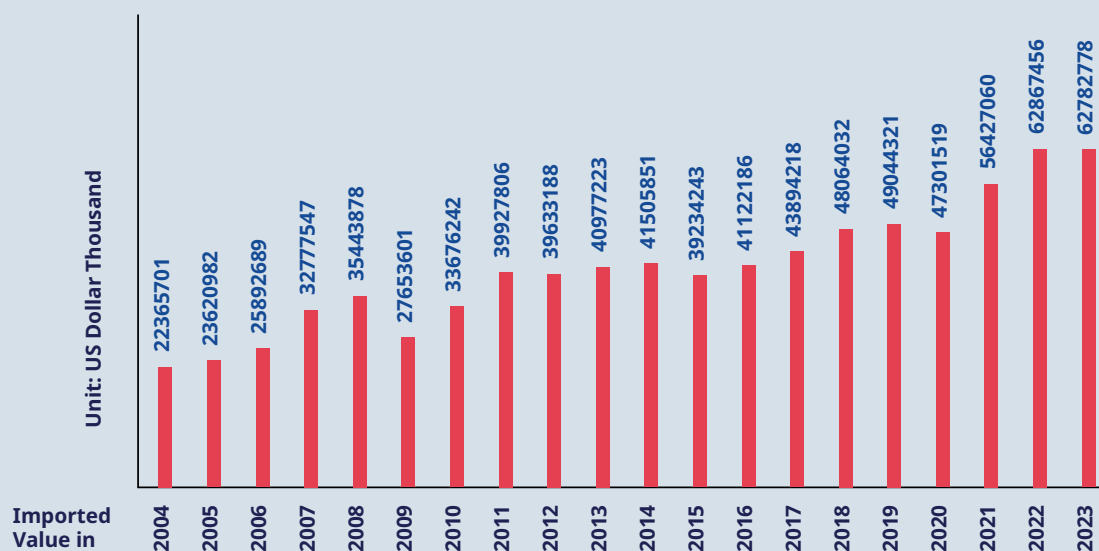
To analyse the trade patterns and trends for products under HS code 8415, which covers air-conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, including those machines in which the humidity cannot be separately regulated, several factors should be considered, such as those listed below.

2.5.1.1 Evolution of exports

The global demand for air-conditioning units has been increasing globally due to increasing urbanization, rising temperatures and improved living standards.

Figure 3 shows that, over the past 20 years, global imports of products classified under HS code 8415 have experienced a nearly continuous increase. However, there have been some fluctuations. For example, in 2020, the COVID-19 pandemic and the resulting halt in global trade caused a significant decline compared with the previous year.

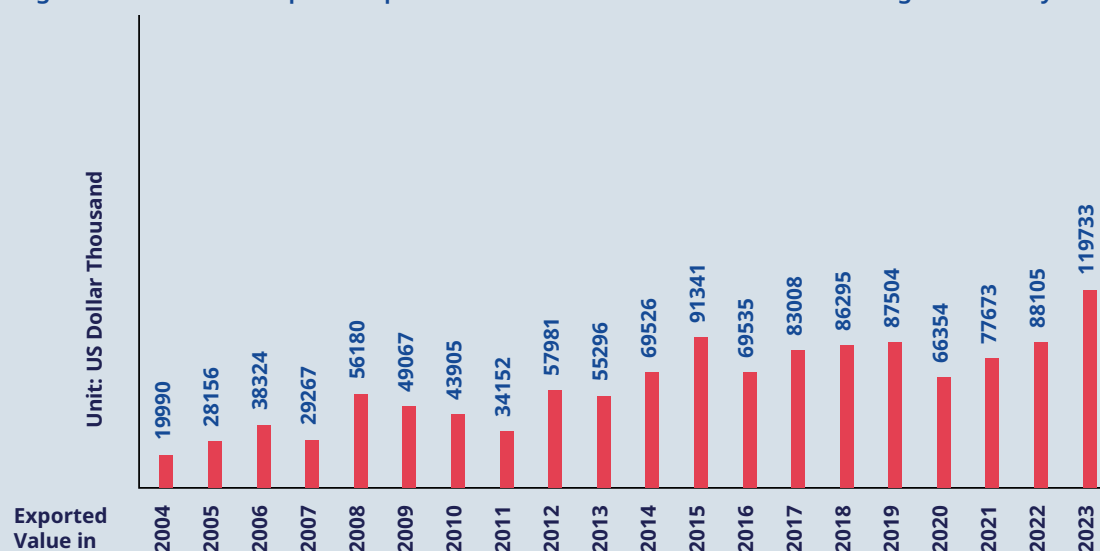
► **Figure 3** Global imports of products classified under HS code 8415 during the last 20 years



Source: ITC (n.d.).

Figure 4 illustrates Jordan's exports of the HS code 8415 product over the past 20 years. A steady increase can be observed in these exports, although there have also been some fluctuations. Notably, in 2020, the COVID-19 pandemic and its impact on global trade caused a significant decline compared with the previous year

► **Figure 4** Global exports of products classified under HS code 8415 during the last 20 years



Source: ITC (n.d.).

2.5.1.2 Top exporters and importers in the sector

The leading exporters of air-conditioning machines, classified under HS code 8415, include several major countries. China is the largest exporter, followed by Mexico, Thailand, the United States and Italy. These countries have substantial production capacities and established supply chains for air-conditioning machines, leading to significant export volumes.

The leading importers of air-conditioning machines (HS code 8415) are the United States, followed by Germany, France and Japan. These countries import significant quantities of air-conditioning units due to their developed economies and high demand for climate control solutions in both residential and commercial sectors.

Jordan is strategically located in the heart of the Middle East, offering ample opportunities to expand its global exports, particularly in industrial and mechanical equipment. Notably, under HS code 8415, which covers industrial fans, ventilators, air-conditioning machines and other climate control equipment, Jordan has significant export potential. This is due to the increasing global demand for energy-efficient and advanced climate control solutions, presenting a major opportunity for Jordan to export these products worldwide. By leveraging competitive production costs and enhancing its technological capabilities, Jordan can diversify its export portfolio and target markets with rising infrastructure demands and a growing need for sustainable energy solutions.

Figures 5, 6 and 7 below clearly outline the export opportunities for engineering products (HS codes 841583, 841582 and 841590³) from Jordan to other countries. It is important to note that information for HS codes 841510, 841520 and 841581 is not available.

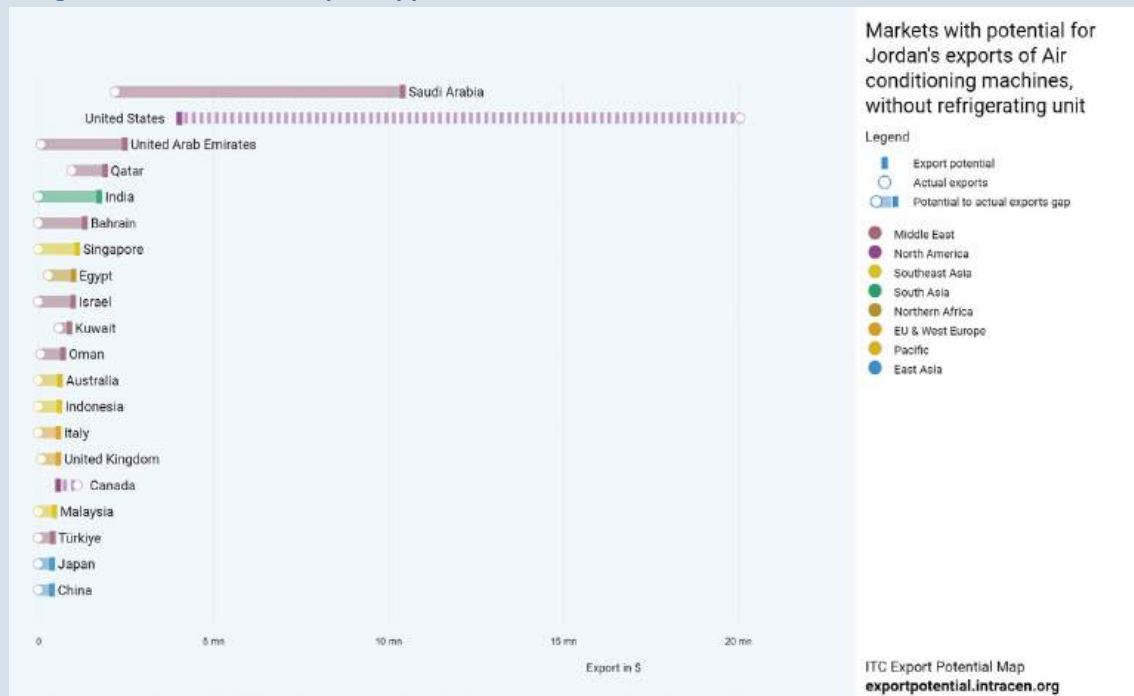
Figure 5 illustrates the export opportunities available for exporting under HS code 841583. It shows the countries with the highest export potential that Jordanian exporters can harness, namely the Kingdom of Saudi Arabia, the United Arab Emirates and the United States.

³ HS code 841583: Air conditioning machines comprising a motor-driven fan, not incorporating a refrigerating unit but incorporating elements for changing the temperature and humidity (excl. of a kind used for persons in motor vehicles, and self-contained or "split-system" window or wall air conditioning machines).

HS code 841582: Air conditioning machines incorporating a refrigerating unit but without a valve for reversal of the cooling-heat cycle (excl. of a kind used for persons in motor vehicles, and self-contained or "split-system" window or wall air conditioning machines).

HS code 841590: Parts of air conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, n.e.s.

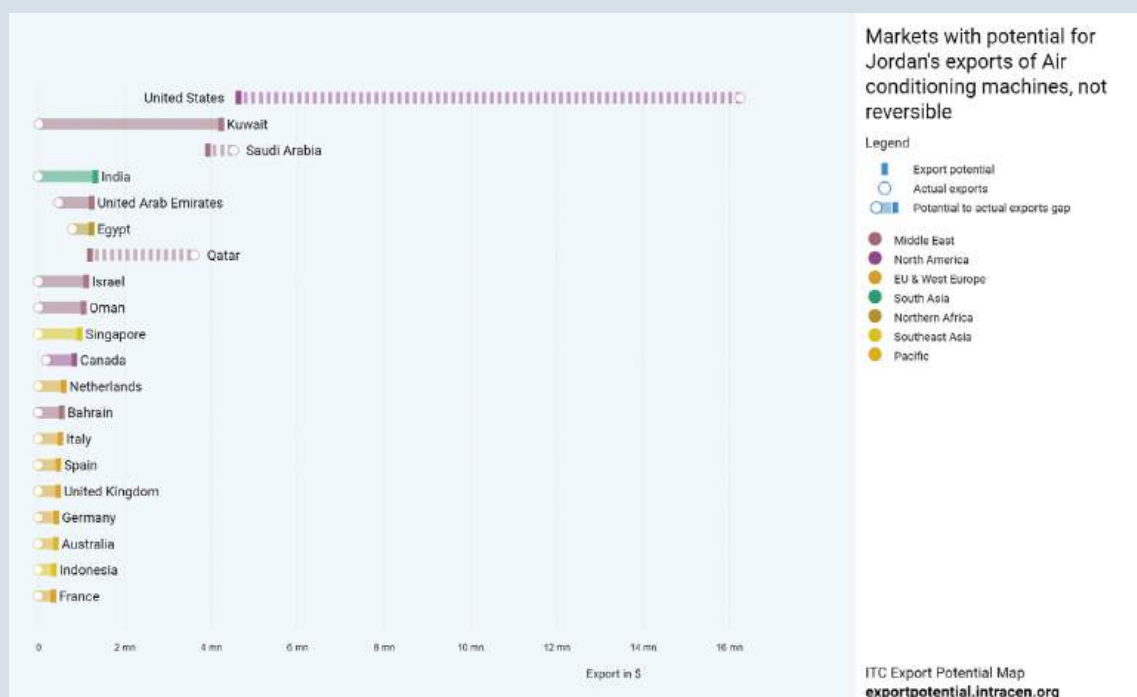
► **Figure 5** Jordan's export opportunities for HS code 841583



Source: ITC (n.d.).

Figure 6 illustrates the opportunities available for exporting under HS code 841582. It shows the countries with the highest export potential that Jordanian exporters can use, namely the Kingdom of Saudi Arabia, Kuwait and the United States.

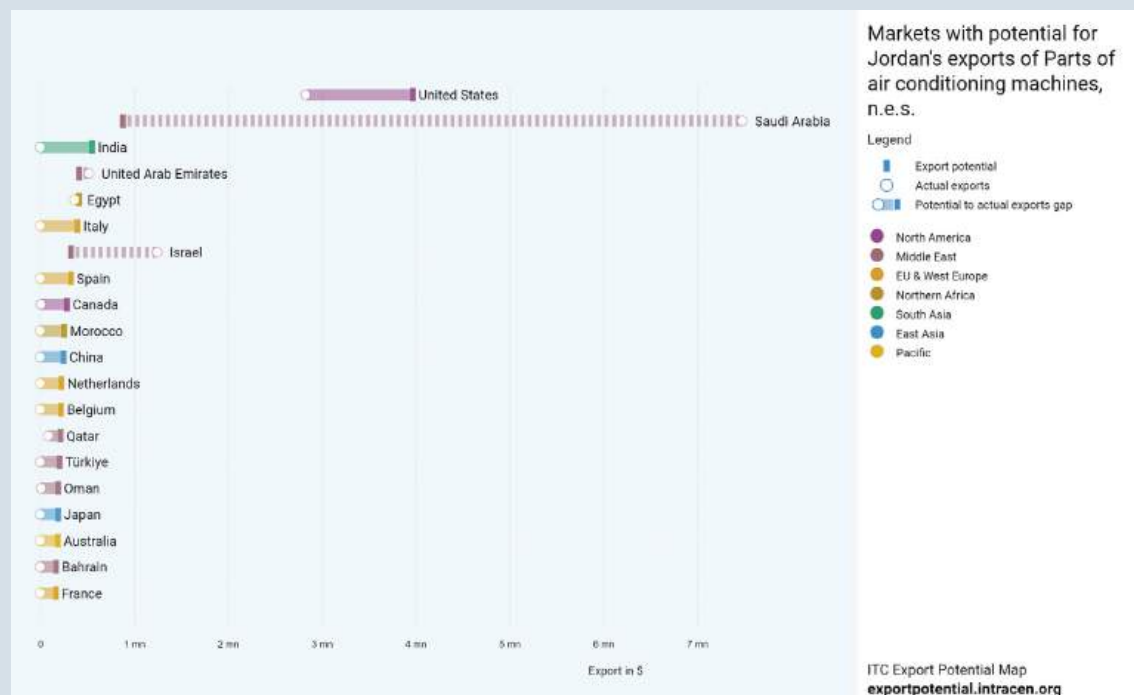
► **Figure 6** Jordan's export opportunities for HS code 841582



Source: ITC (n.d.).

Figure 7 illustrates the opportunities available for exporting under HS code 841590. It shows the countries with the highest export potential that Jordanian exporters can harness, namely India, the Kingdom of Saudi Arabia and the United States.

► **Figure 7** Jordan's export opportunities for HS code 841590



Source: ITC (n.d.).

2.5.2 Engineering services sector

The export of engineering services is a crucial sector that makes a significant contribution to Jordan's economy. Architectural and engineering services contribute to 8–10 per cent of GDP. This sector includes various services such as civil engineering, architectural design, electrical and mechanical engineering, and consulting services. In 2022, Jordan's construction service exports totalled US\$68 million, having decreased from US\$81 million in 2021. Jordan exports to over 31 countries, with the Gulf Cooperation Council countries and Iraq being key markets (USAID, A/E Business Council and Jordan Exports, n.d.).

2.6 Sector employment and skills needs

The engineering sector in Jordan employs a diverse workforce that spans various functions within the value chain, from raw material suppliers to installation and maintenance services. The workforce is characterized by varying levels of education and skills, with a significant proportion of employees holding technical and vocational qualifications. According to the survey's results, 67 per cent of the workforce have a diploma or technical certification, while 23 per cent have a bachelor's degree or higher in engineering.

However, the sector faces a skills mismatch, with employers reporting that 42 per cent of employees require additional training, particularly in areas such as advanced manufacturing and digital skills. This skills gap presents challenges for companies aiming to remain competitive in a rapidly evolving industry.

Additionally, turnover rates in the sector are moderate to high, especially among technicians and junior engineers. Approximately 31 per cent of firms experience turnover rates exceeding 15 per cent annually. Contributing factors to this turnover include working conditions in SMEs, where 40 per cent of employees have expressed dissatisfaction with job stability and benefits.

2.6.1 Engineering products sector

Over the past five years, the air-conditioning, refrigeration and fire equipment sector has consistently been a major employer within the manufacturing industry, starting with 11,147 employees in 2019 and gradually decreasing to 10,128 employees by 2023. This sector accounted for 6.6 per cent of total manufacturing employment in 2023, highlighting its continued significance despite the decline. The reduction in the workforce may be due to technological advancements, automation, market shifts or global competition. Nevertheless, the sector remains crucial, producing essential products and maintaining a stable presence within the manufacturing landscape.

► **Table 4** **Employment in the air-conditioning, refrigeration and fire equipment sector for 2019–23**

Subsector	2019	2020	2021	2022	2023
Air conditioning, refrigeration, fire equipment and their supplies	11,147	11,010	10,696	10,354	10,128
Share of total manufacturing employment	8.5%	7.9%	7.2%	6.9%	6.6%

Source: Jordan Chamber of Industry; authors' survey [May 2024].

► Sector employment disaggregated by sex of employees

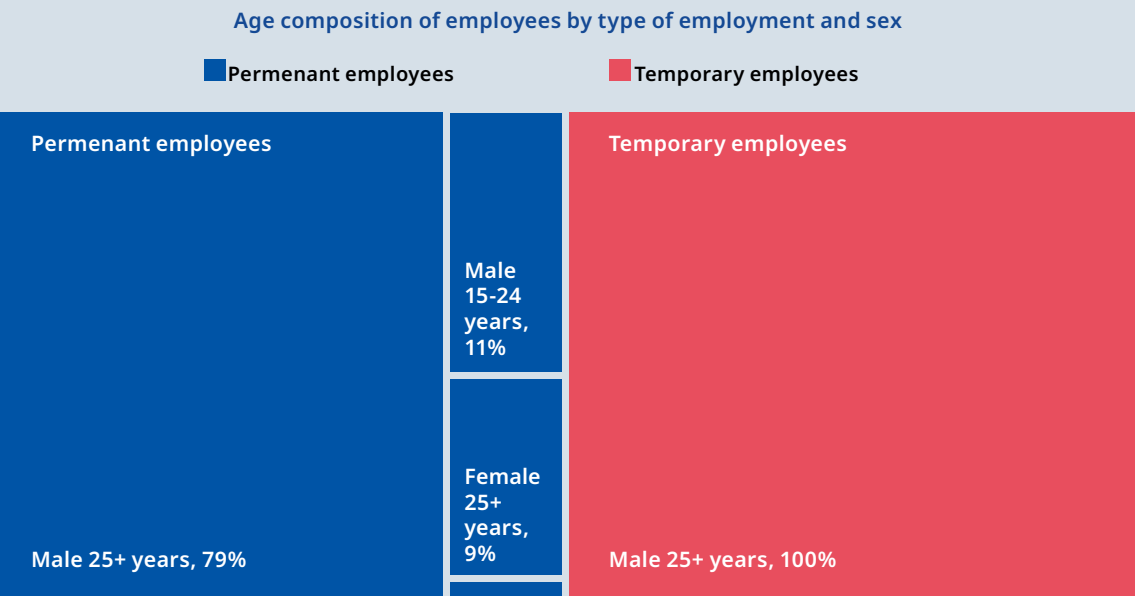
In the engineering products and services sector in Jordan, a significant gender disparity exists in employment. Data from enterprise surveys reveal that men accounted for 84 per cent of total sector employment in 2023, while women represented only 16 per cent.

A further disaggregation in engineering products employment shows a notable difference in gender representation, with women making up only 9 per cent compared to 91 per cent for men. This disparity underscores an imbalance in gender representation within the industry, which can be attributed to societal norms and expectations regarding gender roles. This discrepancy carries various implications, including potential barriers to gender equality in access to employment opportunities, career advancement and income generation within the engineering products sector.

► **Age composition of employees by type of employment and sex**

Figure 8 shows the age and gender composition of employees in the engineering products sector, based on their type of employment. It indicates that the majority of the workforce is male. Men aged 25 and above make up 79 per cent of permanent employees and 100 per cent of temporary employees. Younger men aged 15–24 constitute 11 per cent of permanent employees, while women aged 25 and above represent only 9 per cent. As shown, there are no women or younger men in temporary positions. This implies a heavy reliance on older men for temporary roles, while permanent positions, although slightly more varied in terms of age, remain predominantly male, with limited female representation.

► **Figure 8** Engineering products workforce age and employment distribution by sex



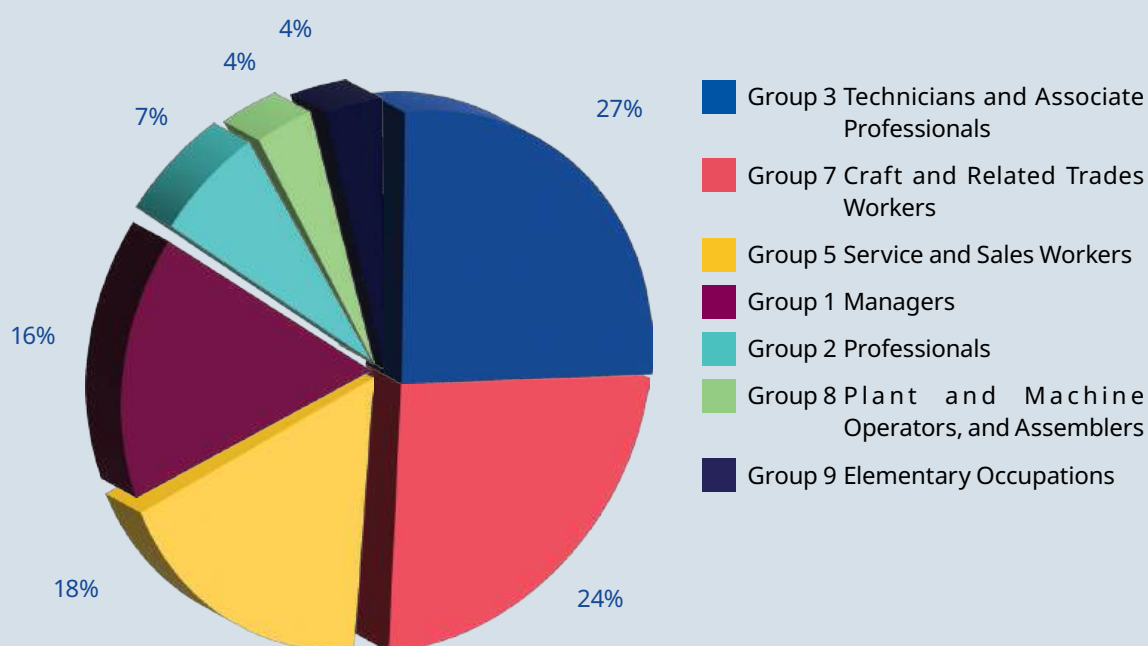
Source: Authors' survey [May 2024].

► **Occupational structure**

The occupational breakdown in the engineering products sector reveals a workforce heavily reliant on technical and trade skills as shown in figure 9. Technicians and associate professionals make up the largest segment at 27 per cent, followed by craft and related trades workers at 24 per cent. This highlights the critical need for specialized technical expertise and practical, hands-on skills in production and assembly. Service and sales workers, who comprise 18 per cent of the workforce, play a significant role in customer interaction and support, essential for market engagement. Professionals, including engineers and project managers, make up 16 per cent, which emphasizes the importance of advanced knowledge and specialized skills for overseeing and developing engineering projects.

Managers, plant and machine operators, and elementary occupations, each constitute 4 per cent of the workforce. Managers provide necessary leadership and oversight, though their numbers are fewer compared to other roles. Plant and machine operators are essential for maintaining precision and efficiency in manufacturing processes, while elementary occupations involve general labour and support tasks crucial for overall operational maintenance. This diverse distribution underscores the sector's reliance on a mix of technical, professional and support roles to ensure its success.

► **Figure 9** Occupational disaggregation in the engineering products sector



Source: Authors' survey [May 2024].

Table 5 provides a detailed overview of the main occupations within the engineering products sector, based on the International Standard Classification of Occupations (ISCO), highlighting the diverse range of roles across various functional areas. Executive and management positions, including senior managers and high-level professionals, are responsible for strategic decision-making and leadership. The processing category features key roles such as production managers, industrial engineers and skilled operators, focusing on the core activities of manufacturing and assembly. Installation and maintenance roles ensure the proper functioning and upkeep of machinery, while sales and customer relations positions drive promotion and engagement with customers. Logistics and supply chain roles, which include supply chain managers and warehouse operatives, are crucial for the efficient movement of materials and products. Additionally, administrative support roles handle financial and accounting tasks, while quality assurance ensures product standards are met. Finally, environmental and safety positions emphasize the sector's commitment to sustainability and workplace safety. Overall, the main occupations reflect the complexity and multidisciplinary nature of the engineering products sector, with a strong focus on production efficiency, supply chain management and compliance with safety and environmental standards.

► **Table 5** Main occupations within the engineering products sector

Category	Roles	Focus
Executive and management	• Senior managers • Other managers and high-level professionals	Strategic decision-making and leadership
Processing	• Production managers • Industrial engineers • Manufacturing engineers • Product development engineers • Production supervisors • Processing technicians • Skilled operators and assemblers • Packing workers	Core production activities: design, development, manufacturing and assembly
Installation and maintenance	• Maintenance engineers • Maintenance technicians	Installation, upkeep and repair of machinery and equipment
Sales and customer relations	• Marketing and sales workers	Promotion, sales and customer engagement
Logistics and supply chain	• Supply chain managers • Procurement managers • Inventory managers • Transport managers • Logistics workers • Supply chain coordinators • Supply chain analysts • Warehouse operatives	Efficient procurement, storage and transportation of materials and products
Administration and support	• Financial and accounting workers	Administrative and financial support
Quality assurance and control	• Quality control inspectors	Ensuring product quality and compliance with industry standards
Environment and safety	• Sustainability coordinators • Safety technicians • Environmental compliance officers	Adherence to environmental regulations and safety standards

Source: Authors' survey [May 2024], results of STED workshop held in July 2024.

Table 6 highlights the essential skills required in the engineering products sector, categorized into technical, soft and sector-specific skills. Technical skills are critical, with a focus on areas such as installation and maintenance, financial management, logistics, sales and marketing, advanced manufacturing technologies such as 3D printing and robotics, and emerging fields such as data analytics, the Internet of things, artificial intelligence applications and cybersecurity. In addition to technical expertise, the sector demands strong soft skills, including customer service, human resources management, effective communication, interpersonal abilities such as empathy and adaptability, innovative problem-solving, and leadership. Furthermore, sector-specific skills, particularly in supply chain management, are crucial for managing logistics and inventory efficiently. These skill sets underscore the need for professionals who are not only technically proficient but also possess the soft skills and specialized knowledge necessary to thrive in the dynamic engineering products market.

► **Table 6** Skills needed in the market for the engineering products sector

Technical skills	Soft skills	Sector-specific skills
• Installation • Maintenance • Financial management • Logistics • Sales and marketing • 3D printing, computer numerical control machining and robotics • Data analytics, the Internet of things, artificial intelligence applications and cybersecurity	• Customer service • Human resources • Effective communication (internal and external) • Interpersonal abilities (empathy and adaptability) • Innovative solutions • Adaptation to new tools and processes • Leadership and resource management	• Supply chain management (logistics and inventory management skills)

Source: Results of STED workshop held in July 2024.

2.6.2 Engineering services sector

2.6.2.1 Sector employment disaggregated by sex of employees

The gender distribution within the engineering services sector, shows that 64 per cent of the workforce is composed of men, while women make up 36 per cent. This significant difference underscores a persistent gender disparity in the field, with men occupying a larger share of employment opportunities. Unlike in the engineering products sector, women represent a considerable portion of the workforce. This imbalance could be reflective of broader societal trends, where traditionally male-dominated fields such as engineering are slowly evolving to become more inclusive but still have progress to make in achieving gender equity.

The engineering services sector accounted for 36.6 per cent of total engineering employment in 2023. As shown in table 7, structural and architectural engineering dominate within the engineering profession, with structural engineering alone accounting for 25.5 per cent of all registered engineers, indicating its critical role in construction and infrastructure projects. This concentration suggests a high degree of specialization and workforce allocation in these fields, driven by the complexity and scale of their projects. In contrast, fields such as building systems and HVAC are underrepresented, likely due to their specialized nature or limited demand, which could present growth opportunities as industry needs evolve. Environmental engineering, while less prominent, plays a moderate role, reflecting the growing but still emerging focus on environmental concerns within the industry, as sustainability and technological advancements become more central to engineering practices.

► **Table 7** Employment in the engineering services sector

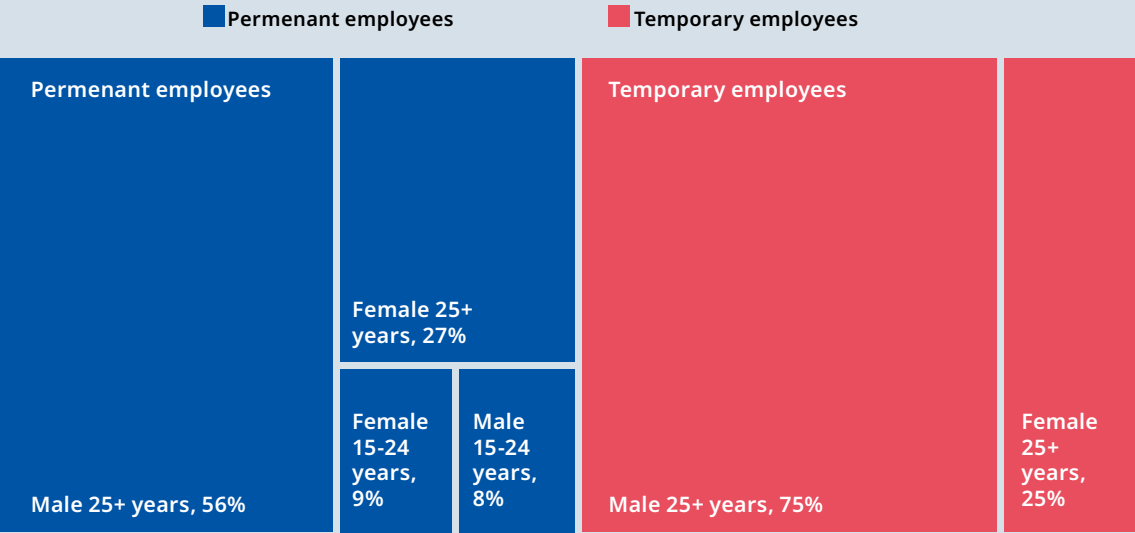
Division	Environmental engineering	Building systems	HVAC	Architectural	Structural
JEA registered	2,530	40	1,773	17,220	49,140
Share of total registered engineers	1.3%	0.02%	0.9%	8.9%	25.5%

Source: JEA (2023)

2.6.2.2 Age composition of employees by type of employment and sex

Figure 10 shows a distinct gender and age-based segmentation within the workforce, particularly in the types of employment. Among permanent employees, older men (25 years and above) dominate, comprising 56 per cent of this group, followed by older women at 27 per cent. Younger workers (15–24 years) are significantly less represented in permanent roles, with young women and men making up only 9 per cent and 8 per cent, respectively. In temporary employment, the disparity is even more evident, with older men making up 75 per cent of the workforce, while older women account for the remaining 25 per cent. This suggests that older men are more prevalent in both permanent and temporary roles, while women and younger workers are less represented, particularly in stable, long-term positions.

► **Figure 10** **Engineering services workforce age and employment distribution by sex**
Age composition of employees by type of employment and sex

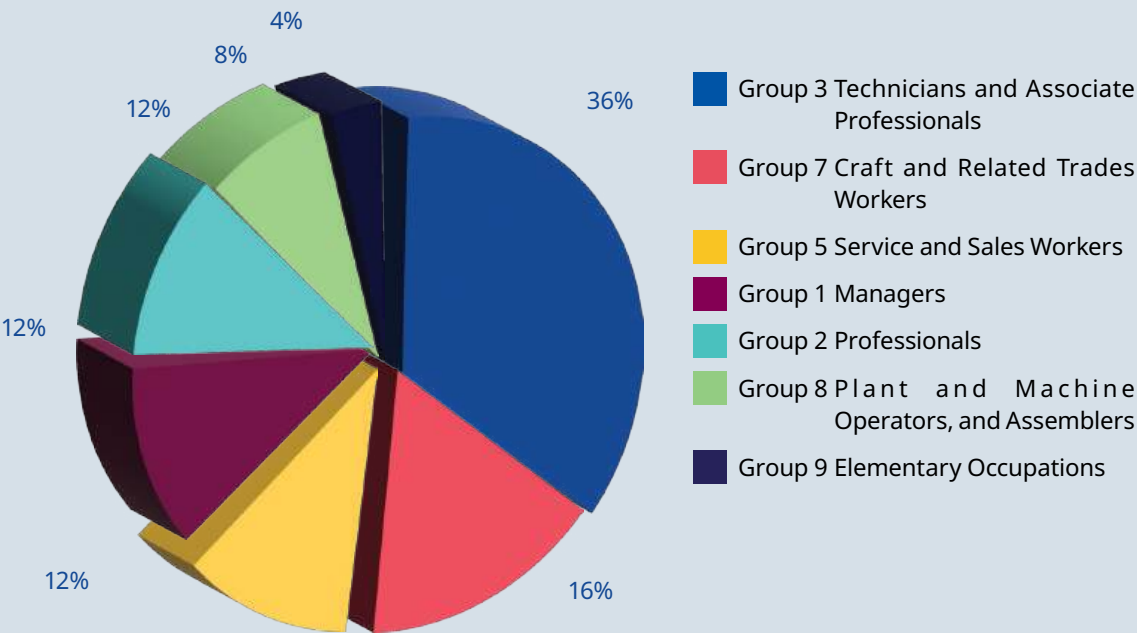


Source: Authors' survey [May 2024].

The occupational breakdown in the engineering services sector reveals a workforce heavily reliant on technical and associate professionals. It is the largest segment, comprising 36 per cent as shown in figure 11, highlighting the demand for medium-skilled workers who typically graduate from TVET programmes. This is followed by craft and related trades workers (16 per cent), emphasizing the importance of hands-on, practical skills in production and maintenance. Additionally, professionals, including engineers and project managers, account for 12 per cent of the workforce, reflecting the need for advanced knowledge and specialized skills.

Clerical support workers and service and sales workers each constitute 12 per cent of the workforce, indicating the importance of administrative support and customer interaction roles. Managers make up 8 per cent, providing essential leadership and oversight, while elementary occupations, comprising 4 per cent, involve general labour and support tasks that are crucial for operational maintenance. This diverse distribution underscores the sector's reliance on a mix of technical, professional, administrative, and general labour roles to ensure its success and efficiency.

► Figure 11 Occupational disaggregation in the engineering services sector



Source: Authors' survey [May 2024].

Table 8, which outlines occupations across various fields, highlights a comprehensive organizational structure. In the **design and development** category, roles such as HVAC design engineers and computer-aided design technicians focus on creating and innovating products and systems. **Project management** professionals, including project managers and site managers, are tasked with overseeing projects from start to finish, ensuring timely and budget-compliant completion. The **processing** category involves production managers and technicians who manage and execute manufacturing processes. **Sales and customer relations** roles, such as customer service workers and marketing and sales workers, are essential for managing customer interactions and driving sales. **Installation and maintenance** cover roles from site engineers to skilled and unskilled workers who handle the setup and upkeep of equipment. Lastly, the **environmental compliance and sustainability** category, with roles such as environmental consultants and safety technicians, focuses on adherence to environmental regulations and promoting sustainable practices. Each category highlights specialized skill sets that are crucial for the smooth functioning of an organization, with various roles often interdependent on one another.

► **Table 8** Main occupations – Engineering services sector

Category	Roles	Focus
Design and development	HVAC design engineers, environmental engineer, structural engineers, architectural engineers, R&D engineers, product development engineers, and computer-aided design technicians	Designing and innovating products and systems
Project management	Project managers, project engineers, site managers and construction managers	Overseeing projects to ensure timely and budget-compliant completion
Processing	Production managers, supervisors and production technicians	Managing and executing manufacturing processes
Sales and customer relations	Customer service workers, and marketing and sales workers	Managing customer interactions and driving sales
Installation and maintenance	Site engineers, medium- to high-skilled workers, and low-skilled workers	Installing and maintaining equipment and systems
Environmental compliance and sustainability	Environmental health and safety managers, environmental consultants, sustainability specialists, environmental compliance officers and safety technicians	Ensuring environmental regulations are followed and promoting sustainability

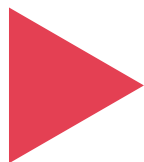
Source: Authors' survey [May 2024], results of STED workshop held in July 2024.

Table 9 highlights the essential skills required in the engineering services sector. Technical skills such as engineering design, sales and marketing, and knowledge of renewable energy sources such as solar and wind power, are essential for developing innovative solutions and staying ahead in a competitive market. Additionally, expertise in green design aligns with the industry's growing focus on sustainability. Soft skills play a vital role, with strong customer service, effective communication and interpersonal abilities being crucial for client interactions and team collaboration. Leadership, negotiation skills and the ability to adapt to new tools and processes further enhance effectiveness in managing projects and teams. Sector-specific skills such as sustainability, energy efficiency and environmental assessments are increasingly important as the sector prioritizes environmental impact and compliance. Integrating these technical, soft and sector-specific skills ensures professionals can navigate the complexities of the engineering services sector while contributing to innovation and sustainability.

► **Table 9** Skills needed in the market for the engineering services sector

Technical skills	Soft skills	Sector-specific skills
• Engineering design • Sales and marketing • Solar and wind power • Expertise in green design	• Customer service • Effective communication (internal and external) • Interpersonal abilities (empathy and adaptability) • Strong leadership • Negotiation skills • Innovative solutions • Effective teamwork and client interactions • Adaptation to new tools and processes • Leadership and resource management	• Sustainability (energy efficiency and environmental assessments)

Source: Authors' survey [May 2024], results of STED workshop held in July 2024



3

► Business Environment

3.1 Legal framework

The engineering sector in Jordan operates under a robust legal and regulatory framework designed to promote industrial growth, ensure quality standards and protect workers' rights. Key institutions include the Ministry of Industry, Trade and Supply, the JSMO and the Ministry of Labour. These bodies set and enforce regulations on product quality, safety standards and labour practices.

The Ministry of Industry, Trade and Supply is responsible for formulating and implementing industrial policy, and for promoting investment and facilitating trade. It plays a crucial role in creating a conducive business environment for the engineering sector through various incentives and support programmes.

The JSMO oversees the development and enforcement of standards and regulations for engineering products, ensuring that they meet both national and international quality standards. It provides certification that enhances the competitiveness of Jordanian products in global markets.

The Ministry of Labour focuses on labour laws and regulations, ensuring fair labour practices and workplace safety. It also supports workforce development through various training programmes in collaboration with other governmental and non-governmental organizations.

3.2 Regulatory bodies

In addition to the Ministry of Industry, Trade and Supply, the JSMO and the Ministry of Labour, other regulatory bodies play a significant role in the engineering sector. The Ministry of Environment ensures compliance with environmental regulations, which is crucial for sustainable engineering practices. The Energy and Minerals Regulatory Commission (EMRC) oversees the energy sector, ensuring that engineering projects meet national energy policies and standards.

- The Ministry of Environment: Enforces environmental regulations and promotes sustainable engineering practices. It ensures that engineering projects undergo environmental impact assessments to minimize environmental harm.
- The EMRC: Regulates the energy sector and ensures compliance with energy policies and standards. It plays a critical role in overseeing projects related to renewable energy and energy efficiency.

3.3 Supporting functions

Supporting functions for the engineering sector in Jordan include financial institutions, training providers and industry associations. Financial institutions such as the Central Bank of Jordan and commercial banks provide essential financing for industrial projects, including loans and credit facilities specifically designed for technology upgrades and expansion.

Training providers, such as the Vocational Training Corporation and various universities, offer specialized programmes to develop the skills needed in the engineering sector. These institutions work closely with industry stakeholders to align their curricula with market demands.

Industry associations, including the JCI and the JEA, play a pivotal role in advocacy, networking and capacity building. They organize seminars, workshops and training sessions to keep their members updated on the latest industry trends and best practices.

3.4 Industry associations and trade unions

Industry associations and trade unions are pivotal in advocating for the interests of engineering professionals and businesses. They provide platforms for networking, professional development and capacity building.

The JEA offers professional development, training and advocacy for engineers. It plays a role in ensuring that engineering practices adhere to ethical and professional standards. The Jordan Industrial Estates Corporation also supports the development of industrial estates and provides infrastructure and services to engineering firms.

3.5 Government policies and initiatives

Government policies and initiatives aim to enhance the competitiveness and sustainability of the engineering sector. These include strategic plans, incentives and support programmes, such as:

- The Economic Modernisation Vision: Aims to transform Jordan into a regional industrial hub through high-growth exports featuring high-quality and high-value products.
- The Investment Promotion Strategy (2023–2026): Focuses on attracting foreign and local investment in high-value industries, including the engineering sector.
- The National Strategy for Human Resource Development 2016–2025: Aims to improve the skills and education of the workforce, ensuring that it meets the demands of the engineering sector.

3.6 Funding mechanisms

Funding mechanisms include government grants, international aid and private sector investment, and are essential for financing industrial projects, technology upgrades and expansion. Such mechanisms include:

- The Jordan Investment Commission: Provides incentives for foreign and local investors in the engineering sector. Incentives include tax breaks, customs exemptions, and support for research and development.
- International funding: Organizations such as the World Bank, the European Union and USAID offer financial support for various engineering projects. These funds are often directed towards capacity building, infrastructure development and sustainable practices.
- Private sector investments: Local banks and financial institutions offer loans and credit facilities specifically designed for technology upgrades and expansion in the engineering sector.

3.7 Market access overview

In 2000, Jordan confidently became a member of the WTO, thereby enjoying remarkable benefits. Joining the organization provided Jordan with access to the markets of 163 countries for its exports of goods and services. This access was governed within a clear and transparent environment, ensuring adherence to procedures, laws and regulations as per the rules and agreements of the organization. Moreover, Jordan's membership in the WTO has provided an unequivocally attractive environment for investment and business.

For the purpose of this study, it is important to shed light on the meaning of market access and to distinguish it from free trade agreements.

3.7.1 Market access

Market access is the ability and opportunity for companies or countries to effectively and competitively sell their goods and services in overseas markets. This includes navigating and complying with a range of conditions, including tariff rates, quotas and regulations that importing countries impose on foreign goods and services. The intricacies of market access determine the relative ease or difficulty for international products to enter and compete in a domestic market. Various barriers, such as regulatory restrictions, trade tariffs and non-tariff barriers, can significantly affect market access and create challenges for foreign businesses seeking to enter new markets. Market access can be influenced by various barriers, such as:

- **Tariffs:** Taxes imposed on imported goods.
- **Quotas:** Limits on the amount of a specific product that can be imported.
- **Licensing requirements:** Special permission required to import certain goods.
- **Standards and regulations:** Health, safety, environmental and technical standards that imports must meet.

3.7.2 Free trade agreements

Free trade embodies the absence of barriers and signifies the removal of tariffs, quotas and other restrictions that countries impose on each other to protect their domestic industries. The ultimate goal of free trade is to allow goods and services to move more freely across borders, thereby promoting economic efficiency and growth. Key elements of free trade include:

- **Elimination of tariffs:** No taxes on imported goods.
- **Removal of quotas:** No limits on the quantity of goods that can be imported or exported.
- **Reduction of non-tariff barriers:** Minimizing regulations, standards, and other measures restricting trade.

Jordan has proactively sought free trade agreements to strengthen its economic integration with various regions and amplify its trade and investment. Prominent free trade agreements to which Jordan is currently party include:

► **Jordan-European Union Association Agreement (EUAA)**

- Date signed: 1997
- Entered into force: 2002
- Description: This agreement aims to establish a free trade area between Jordan and the European Union by gradually reducing tariffs on industrial goods and providing preferential access for agricultural products.

► **United States-Jordan Free Trade Agreement (US-JO FTA)**

- Date signed: 2000
- Entered into force: 2001
- Description: The United States-Jordan Free Trade Agreement was the first United States free trade agreement with an Arab country. It eliminates tariffs and barriers to trade in goods and services, provides robust intellectual property protection, and includes provisions on labour and environmental standards.

► **Greater Arab Free Trade Area (GAFTA) agreement**

- Date signed: 1997
- Entered into force: 1998
- Description: The Greater Arab Free Trade Area is the product of a pan-Arab trade agreement aimed at creating a regional free trade area among the Arab countries. The agreement focuses on eliminating tariffs and trade barriers.

► **Jordan-European Free Trade Association (EFTA) Free Trade Agreement**

- Date signed: 2001
- Entered into force: 2002
- Members: Iceland, Liechtenstein, Norway and Switzerland
- Description: This agreement seeks to promote trade relations between Jordan and the EFTA States by eliminating tariffs on industrial products and providing concessions on agricultural products.

Table 10 below outlines the market access conditions according to the access market map for potential markets and products, offering detailed information on non-tariff measures and trade regulations. These data are vital for making informed decisions about market entry, developing export strategies, and identifying high-potential markets. By comparing conditions across different markets, companies can pinpoint the most favourable opportunities. Analysts can also leverage this information to conduct research and better understand trade dynamics, supporting Jordanian manufacturers in their strategic planning for international expansion.



Jordan. 2018 © Abdel Hameed Al Nasier/ILO

The main observations from the table reveal significant differences in market access conditions across various countries for air-conditioning products, which have critical implications for Jordanian manufacturers. Tariff barriers (most-favoured-nation tariffs) are considerably higher in Iraq (up to 60 per cent) and Egypt (40–60 per cent) compared to countries such as Germany and the United States, where duties are much lower or zero. This suggests that Jordanian exports may face substantial cost barriers in Iraq and Egypt, limiting competitiveness in these markets. Conversely, Germany and the United States present more favourable conditions, with their lower tariffs and the absence of trade remedies.

In terms of regulatory requirements, there is also significant variation, with China and Germany imposing the most stringent regulations, while Lebanon and the United States have fewer measures. For Jordanian companies, this means that navigating regulatory compliance in Germany may be more challenging, while entry into markets like Lebanon or the United States may be comparatively easier.

► **Table 10** Market access conditions

Code and product label	Market access conditions	China	Egypt	Germany	Iraq	Kingdom of Saudi Arabia	Lebanon	United States
HS 841583 – Air-conditioning machines comprising a motor-driven fan, not incorporating a refrigerating unit but incorporating elements for changing the temperature and humidity (excluding of a kind used for persons in motor vehicles, and self-contained or “split-system” window or wall air-conditioning machines)	MFN duties (applied)	8%	60%	0%	NA	15%	20%	1.4%
	Preferential tariff		0%			0%	0%	0%
	Trade remedies	China does not apply any trade remedy on the selected product.	Egypt does not apply any trade remedy on the selected product.	Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.	Lebanon does not apply any trade remedy on the selected product.	The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 60	Total measures 36	Total measures 28		Total measures 13	Total measures 3	Total measures 38

Code and product label	Market access conditions	China	Egypt	Germany	Iraq	Kingdom of Saudi Arabia	Lebanon	United States
HS 841582 – Air-conditioning machines incorporating a refrigerating unit but without a valve for reversal of the cooling-heat cycle (excluding of a kind used for persons in motor vehicles, and self-contained or “split-system” window or wall air-conditioning machines)	MFN duties (applied)	8%	60%	0%	NA	15%	20%	2.2%
	Preferential tariff		0%			0%	0%	0%
	Trade remedies	China does not apply any trade remedy on the selected product.	Egypt does not apply any trade remedy on the selected product.	Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.	Lebanon does not apply any trade remedy on the selected product.	The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 73	Total measures 36	Total measures 28		Total measures 13	Total measures 3	Total measures 42
HS 841590 - Parts of air-conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, n.e.s.	MFN duties (applied)	8%	40%	0%	NA	10%	20%	1.4%
	Preferential tariff		0%			0%	0%	0%
	Trade remedies	China does not apply any trade remedy on the selected product.	Egypt does not apply any trade remedy on the selected product.	Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.	Lebanon does not apply any trade remedy on the selected product.	The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 42	Total measures 33	Total measures 30		Total measures 13	Total measures 3	Total measures 19
HS 841510 – Air-conditioning machines designed to be fixed to a window, wall, ceiling or floor, self-contained or “split-system”	MFN duties (applied)	8%	NA	2.2%	NA	15%	20%	0%
	Preferential tariff			0%		0%	0%	
	Trade remedies	China does not apply any trade remedy on the selected product.		Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.	Lebanon does not apply any trade remedy on the selected product.	The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 72		Total measures 26		Total measures 13	Total measures 3	Total measures 26

Code and product label	Market access conditions	China	Egypt	Germany	Iraq	Kingdom of Saudi Arabia	Lebanon	United States
HS 841520 – Air-conditioning machines of a kind used for persons, in motor vehicles	MFN duties (applied)	10%	5%	2.7%	NA	5 %	NA	1.4%
	Preferential tariff		0%	0%		0%		0%
	Trade remedies	China does not apply any trade remedy on the selected product.	Egypt does not apply any trade remedy on the selected product.	Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.		The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 53	Total measures 32	Total measures 27		Total measures 13		Total measures 17
HS 841581 – Air-conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling-heat cycle “reversible heat pumps” (excluding of a kind used for persons in motor vehicles and self-contained or “split-system” window or wall air-conditioning machines)	MFN duties (applied)	8%	NA	0 %	NA	15%	20%	1%
	Preferential tariff					0%	0%	0%
	Trade remedies	China does not apply any trade remedy on the selected product.		Germany does not apply any trade remedy on the selected product.		The Kingdom of Saudi Arabia does not apply any trade remedy on the selected product.	Lebanon does not apply any trade remedy on the selected product.	The United States does not apply any trade remedy on the selected product.
	Regulatory requirements	Total measures 69		Total measures 28		Total measures 13	Total measures 3	Total measures 38

Source: ITC (n.d.).



► Envisioning the future

The following findings are derived from the proposals presented by experts and stakeholders from various entities during the STED workshop. These proposals reflect collaborative efforts to address occupation-specific skills gaps and systemic constraints within the engineering products and services sector in Jordan. The insights and recommendations gathered from these proposals offer a comprehensive framework for enhancing the sector's competitiveness, fostering innovation and improving overall performance. Through targeted training programmes and strategic initiatives, the proposals aim to address critical skill shortages and elevate the sector's position in both local and international markets (see Annex II for the perspective of other ecosystem and international players on market opportunities and challenges in the engineering sector in Jordan).

4.1 Market opportunities and challenges

The comprehensive analysis of the challenges faced by stakeholders in Jordan's engineering sector, derived from the technical and policy foresight workshop, quantitative surveys and qualitative key informant interviews, reveals a multifaceted landscape of obstacles and opportunities across various segments of the industry.

4.1.1 Engineering products sector

The technical and policy foresight workshop conducted in July 2024 identified key market opportunities across national, regional and international markets, with the air-conditioning sector offering notable potential for growth. Nationally, the market for air conditioning is projected to grow by 60 per cent, driven by the adoption of energy-saving and alternative energy systems, the use of air-conditioning systems for heating purposes, and the impacts of climate change. Regionally, the air-conditioning market is also expected to expand, influenced by similar factors, along with the Arab League Agreement, which facilitates trade. Customized production to meet specific client specifications, supported by laws and regulations that protect and secure exports, as well as industry and export support programmes, further enhance regional opportunities. Internationally, growth is anticipated due to global trends toward energy-saving systems, climate change and international trade agreements, alongside industry and export support initiatives.

The Kingdom of Saudi Arabia, with its booming construction sector and high demand for advanced air-conditioning and refrigeration systems, stands out as a significant export market opportunity. Other potential markets include China, Egypt, Germany, Iraq, Lebanon and the United States. Compliance with international quality standards, such as CE marking, ISO 9001 (quality management systems), ISO 14001 (environmental management systems) and ISO/IEC 17025 (testing and calibration laboratories), is crucial for exporting to these high-potential markets. Additionally, increasing local sourcing of components, such as air-conditioning machine parts, compressors, heat exchangers and electronic controls, can enhance competitiveness by reducing costs and improving production efficiency. The integration of technological advancements, including 3D printing, robotics, automation systems and smart technologies, is pivotal in reshaping production processes and product capabilities, thereby bolstering Jordan's position in both domestic and international markets.

Competition presents varying challenges across different markets. Nationally, there are opportunities for competition in the commercial market, which remains undersupplied relative to demand, providing room for growth. Regionally, competition is more challenging, though Jordanian products have established a strong reputation. Internationally, competition is intense, particularly in markets such as Iraq, the Kingdom of Saudi Arabia, the United Arab Emirates and the United States. However, Jordan's engineering products are distinguished by their excellence in meeting international specifications and passing rigorous tests.

Comparative advantages of Jordan's engineering products are evident across various markets. Nationally, advantages include flexibility in productivity, quick adaptation to new technologies, the ability to customize products to meet specific customer requirements, high engineering expertise, and competitive pricing relative to quality. Regionally, with regard to its products, Jordan is recognized for its good reputation, rapid adoption of new technologies, competitive pricing and a geographic advantage that facilitates trade. Internationally, Jordan benefits from its strategic geographic location and free industrial trade agreements, which reduce barriers and enhance trade and investment ties with other countries.

Changes in products and services are observed across different market levels. Nationally, there is a shift towards using alternative and environmentally friendly systems adopted by the Jordanian companies. Regionally, the introduction of artificial intelligence systems and the integration of technology with local products are emerging trends. Internationally, the focus is on meeting the specific requirements of international markets, particularly in aligning with the scale of market demand.

Routes to market also differ depending on the market level. Nationally, trade shows, along with digital and traditional marketing strategies, are effective avenues for market entry. Regionally, the Arab League Agreement, commercial exchanges and trade delegations play crucial roles in facilitating market access. Internationally, free trade agreements, participation in international exhibitions, and comprehensive market studies are essential for successful market penetration.

Despite these opportunities, according to the survey among engineering products companies in Jordan, the industry faces significant challenges. Financial constraints were a major issue for raw material suppliers and aggregators, with 38 per cent and 41 per cent, respectively, identifying this as a primary barrier, while manufacturers did not see it as a major challenge. Investment capital was a critical concern for both raw material suppliers (89 per cent) and aggregators (84 per cent), and working capital was particularly crucial for aggregators (63 per cent). Other financial aspects, such as payments, asset management and access to finance, presented moderate challenges for both categories but not for manufacturers. Access to markets, both local and international, was a minor concern for raw material suppliers (15 per cent) and aggregators (5 per cent), with no impact on manufacturers. Customer linkages were notably important for raw material suppliers (78 per cent), while market access requirements posed a challenge for aggregators (21 per cent).

The regulatory environment poses a moderate challenge for aggregators (16 per cent) and a minor challenge for raw material suppliers (7 per cent), with no significant impact on manufacturers. Competition rules are a significant issue for aggregators (58 per cent) and raw material suppliers (33 per cent). Manufacturers face substantial challenges related to macroeconomic conditions, with 100 per cent highlighting this as a critical constraint. Macroeconomic conditions and forex market conditions are particularly pressing issues for manufacturers. Physical inputs, such as access to component inputs, are minor issues for both raw material suppliers (2 per cent) and aggregators (3 per cent), with no significant impact on manufacturers. Within this category, access to raw materials and component parts are noted as challenges for aggregators.

Enabling services, including transport and logistics, posed considerable challenges for aggregators (16 per cent), while they were less of an issue for raw material suppliers (4 per cent) and irrelevant for manufacturers. Aggregators struggled specifically with transport and logistics, business support services, packaging, and marketing and distribution. Land and utilities were a minor concern for both raw material suppliers (2 per cent) and aggregators (6 per cent), with no impact on manufacturers. Specific issues within this category include storage and waste management for aggregators.

In summary, the engineering products sector in Jordan holds significant potential for growth, particularly in national, regional and international markets. Nationally, the sector is poised to benefit from the anticipated 60 per cent growth in the air-conditioning market, driven by energy-saving technologies, alternative energy systems and climate change. Regionally, opportunities arise from the Arab League Agreement, protective export laws and supportive industry programmes, although competition remains challenging. Internationally, the sector can leverage free trade agreements and participation in global trade shows to enhance its presence in key markets.

Despite these opportunities, the sector faces substantial challenges, particularly for raw material suppliers and aggregators. Financial constraints, especially in investment and working capital, are critical barriers for these groups. Macroeconomic conditions and access to enabling services such as transport, logistics and business support are also significant challenges. Manufacturers, however, are primarily concerned with macroeconomic stability and competition in both local and global markets.

To fully realize the sector's potential, targeted interventions are essential. These include improving access to finance, streamlining regulatory processes, enhancing enabling services and fostering technological advancements like 3D printing and automation. Additionally, the industry must focus on compliance with international quality standards to succeed in high-potential markets such as the Gulf Cooperation Council countries, the United States and Europe.

In conclusion, while the engineering industries sector in Jordan is well positioned for growth, addressing the identified financial, regulatory and macroeconomic challenges is crucial. By doing so, the sector can capitalize on emerging opportunities, improve its competitiveness and strengthen its role in both domestic and international markets.

4.1.1.1 Obstacles for export expansion

1. Market access and regulatory barriers:

- Compliance with international regulations and standards (for example, CE marking and SASO standards) is a major challenge.
- 68 per cent of surveyed firms identified regulatory compliance as a barrier.
- 45 per cent of surveyed firms specifically cited difficulties in meeting international quality standards.

2. Financial constraints:

- Limited access to finance restricts the ability of firms to invest in technology upgrades and expansion needed for competitive exports.
- Approximately 54 per cent of surveyed firms reported financial constraints as a significant hindrance to export growth.
- Only 30 per cent of firms indicated that they had access to sufficient funding to support their export activities, highlighting a critical gap in financial support.

3. Logistical challenges:

- Inefficiencies in logistics and high shipping costs impede export potential.
- 47 per cent of surveyed firms faced logistical challenges, affecting timely delivery and cost competitiveness.
- 35 per cent of surveyed firms reported a lack of reliable shipping services.

4.1.1.2 Threats and challenges facing enterprises

1. Global competition:

- Intense competition from technologically advanced countries, especially China and East Asian States.
- 63 per cent of surveyed firms saw competition from these regions as a significant threat.

2. Technological lag:

- Local firms struggled to keep up with technological advancements.
- 58 per cent of surveyed firms needed substantial technological upgrades.

3. Market volatility:

- Economic and political instability in key export markets such as Iraq and Lebanon.
- 38 per cent of firms were concerned about market volatility affecting export strategies.

4.1.2 Engineering services sector

The technical and policy foresight workshop conducted in July 2024 revealed key market opportunities across national, regional, and international markets, with the engineering services sector offering notable potential for growth. Nationally, growth opportunities are driven by the establishment of a new, effective strategy for the sector services and thorough assessments of market needs. Regionally, growth is expected from the assessment of regional market needs, the development of a regulatory framework, and the adoption of innovation and technology. Internationally, innovation, accessibility and globalization are key factors driving growth.

Competition within the engineering services sector varies across markets. Nationally, reducing the cost of services, enhancing capacity building through the national education system (for example, through the Business and Technology Education Council (BTEC) programme, and the diversity of service providers contribute to better service quality and lower costs. Regionally and internationally, collaboration and aggregation among engineering services companies are essential strategies to offer better services and compete effectively. Additionally, reducing taxes on exports is crucial for enhancing international competitiveness.

Jordan's comparative advantages in engineering services are evident across different markets. Nationally, these include encouraging consumer behaviour, leveraging low wages with a high-quality workforce, and utilizing a talented and skilled human resource base supported by a strong high-level education system. Regionally, the same advantages—low wages, skilled workforce and a robust education system—are pivotal. Internationally, Jordan's strategic geographic location and the updating of international agreements provide significant advantages.

Changes in products and services reflect the engineering services sector's adaptation to evolving market demands. Nationally, there is a focus on developing eco-services, recycling and waste management services and cost-effective solutions, as well as implementing internal funds and prizes, and risk management planning. Regionally, resilience, risk management planning and certification are key trends. Internationally, risk management planning and conformity with international standards are critical for success.

Routes to market differ across levels. Nationally, field visits, networking conferences, and market openings are effective strategies. Regionally, trade treaties and agreements within the region are essential for market access. Internationally, international trade treaties, agreements and participation in global exhibitions are crucial for market penetration.

In the context of the green transition, the technical and policy foresight workshop highlighted several key opportunities and challenges arise from the interaction between engineering services and sustainable practices.

► **Table 11** **Green transition - Engineering services**

Item	Opportunities	Challenges
Sustainable practices and technologies	There are opportunities for growth due to existing studies and regulations for environmental assessments from the Ministry of Environment.	Limited number of qualified entities providing environmental study services, which are often expensive and may face rejection
Changing trade dynamics and supply chains	Technological advancements offer opportunities for increased diversity and alignment with international trends.	Fluctuating shipping costs during imports and changes in work methodologies within engineering offices, which can disrupt work schedules
Impact of skills and workforce	There are opportunities for acquiring new skills, creating job opportunities for engineering offices, and increasing training programmes.	Lack of commitment from engineering offices to build functional capabilities and competencies
Environmental management	There are economic benefits for the engineering consulting sector resulting from green transformation initiatives.	Lack of experience in environmental management and the additional costs associated with it
Changing consumer preferences	The diversity of options available to consumers, along with the abundance of engineering offices, presents opportunities for these offices to meet evolving consumer demands and raise awareness about the green transition.	Sudden and continuous changes in laws and regulations related to the green transition, leading to higher costs for consumers
Regulations, standards and compliance	Flexibility is allowed by development standards and regulations.	Sudden and continuous changes in laws and legislation, which can restrict the ability of engineering offices to implement and achieve required compliance
Corporate social responsibility and community engagement	Engineering offices can benefit by offering services through partnerships or direct engagement with local communities, which can enhance profits, build trust and create job opportunities.	Lack of effective partnerships and communication channels, and low confidence levels within the community

Source: STED workshop (Technical and Policy Foresight workshop), Amman July 2024.

Despite these opportunities, according to the survey among companies in the engineering services sector, the industry faces distinct constraints. For raw material suppliers, financial constraints were not a significant issue, with a 0 per cent indication across all financial subcategories. In contrast, processors reported finance as a notable challenge (13 per cent), with a particular emphasis on investment capital (50 per cent) and payments (50 per cent). This suggests that, while raw material suppliers are relatively stable financially, processors face difficulties in securing investment and managing payment systems. Access to markets, both local and international, was not a major concern for raw material suppliers (0 per cent), but it presented some challenges for processors (8 per cent). Specifically, processors highlighted customer awareness (50 per cent) as a significant barrier, indicating a need for better market penetration and customer engagement strategies.

The regulatory environment posed no challenges for raw material suppliers (0 per cent), but it was a considerable issue for processors (20 per cent). Within this domain, law enforcement and arbitration (50 per cent) and investment and business bureaucracy (50 per cent) were key regulatory hurdles for processors, suggesting that regulatory reforms and streamlined bureaucratic processes could greatly benefit this group. Macroeconomic conditions emerged as a critical challenge for processors (33 per cent), with 100 per cent highlighting it as a significant barrier. This starkly contrasts with raw material suppliers, who reported no issues in this category. The reliance of processors on stable macroeconomic conditions underscores the vulnerability of their operations to economic fluctuations.

Physical inputs, including access to component inputs, were a minor concern for processors (8 per cent) but were not an issue for raw material suppliers. Among processors, machinery access was particularly challenging (50 per cent), indicating a need for improved access to advanced equipment and technology. Enabling services, such as transport and logistics, posed a minor challenge for processors (6 per cent), with no significant issues reported by raw material suppliers. Within this category, R&D (50 per cent) and transport infrastructure (50 per cent) were critical for processors, suggesting that investments in R&D and improvements in transport infrastructure could enhance their operational efficiency. Land and utilities were a minor concern for processors (7 per cent) and not a significant issue for raw material suppliers. This indicates that, while land and utility services are relatively stable, there is still room for improvement, particularly in ensuring adequate infrastructure for processors.

In summary, the engineering services sector in Jordan is characterized by a mix of opportunities and challenges, varying across national, regional and international markets. Nationally, growth is driven by strategic planning and market assessments, with a focus on reducing service costs, enhancing the quality of the workforce and encouraging consumer behaviour. Regionally and internationally, collaboration, innovation, and the updating of trade agreements are key to competitiveness, alongside the engineering services sector's inherent advantages, such as a skilled workforce and strategic geographic location.

However, the sector faces distinct constraints, particularly for processors, who struggle with financial challenges, including investment capital and payment systems, as well as regulatory hurdles and macroeconomic instability. Raw material suppliers are relatively stable financially but face challenges in market access, particularly in raising customer awareness. Physical inputs, enabling services such as R&D and transport infrastructure, and access to advanced machinery, are additional areas where processors need support.

The green transition introduces both opportunities and challenges, especially in areas such as sustainable practices, changing trade dynamics, skill development and environmental management. Engineering services have the potential to leverage these opportunities through targeted interventions, including by improving access to finance, streamlining regulatory processes, investing in advanced technology and infrastructure, and adopting sustainable practices.

In conclusion, while the sector is positioned to capitalize on growth opportunities, addressing the identified challenges – particularly those related to finance, regulation and macroeconomic conditions – will be crucial for supporting market expansion and enhancing the competitiveness of Jordan's engineering services both domestically and internationally.

4.1.2.1 Obstacles for export expansion

1. Skills and expertise gaps:

- There is a significant shortage of skilled professionals in the sector.
- 62 per cent of surveyed firms identified a lack of skilled workforce as a major barrier.

2. International market competition:

- There is a high level of competition from established firms in developed countries.
- 58 per cent of Jordanian firms saw international competition as a major obstacle.

3. Regulatory and certification barriers:

- Compliance with international standards and certifications constitutes a major barrier.
- 55 per cent of surveyed firms highlighted regulatory and certification barriers as significant challenges.

4.1.2.2 Threats and challenges facing enterprises

1. Global competition:

- Jordanian firms face fierce competition from countries with advanced technological capabilities.
- Competition from international players is a significant threat to growth.

2. Technological lag:

- Technological lag limits the ability to innovate and meet international standards.
- Smaller enterprises, in particular, struggle with technological adoption.

3. Market volatility:

- Volatility in export markets, such as Iraq and Lebanon, poses risks to business stability.
- Surveyed firms were concerned about the impact of market instability on export growth.

4.2 Drivers for future growth

The following section discusses the potential for growth and development within the engineering products sector and engineering services sector. Additional perspectives on growth potential were explored and validated during the STED workshop (see Annex III).

4.2.1 Engineering products sector

The engineering products sector in Jordan demonstrates significant potential for growth and development. Several factors contribute to this potential, each of which is essential for driving the sector's expansion and enhancing its competitiveness.

1. High potential markets for export:

The engineering products sector, which constitutes 14.1 per cent of Jordan's manufacturing exports according to the Economic Modernisation Vision, shows promising opportunities for growth in international markets. Based on the survey findings, the Gulf Cooperation Council countries, particularly the Kingdom of Saudi Arabia, present substantial market potential, driven by a thriving construction sector and a high demand for advanced air-conditioning and refrigeration systems. Other notable markets with potential for expansion include Egypt, Iraq, Lebanon and the United States.

2. Local sourcing and procurement:

Enhancing local sourcing of components such as parts for air-conditioning machines, including motor-driven fans and elements that regulate temperature and humidity, as well as compressors, can indirectly increase the competitiveness of Jordanian firms. By procuring inputs locally, companies can benefit from reduced costs while supporting the domestic market. It is noteworthy that most firms within the engineering products sector are private, local and Jordanian-owned.

3. National policy to promote high-value industry:

The engineering products sector is recognized as a "high value industry" within Jordan's Investment Promotion Strategy. This strategic designation underscores the sector's importance in transforming Jordan into a regional industrial hub. The focus is on fostering high-growth exports that are characterized by high-quality and high-value products, which aligns with Jordan's broader economic development goals.

4.2.2 Engineering services sector

The engineering services sector in Jordan is poised for significant growth, driven by a combination of high potential markets, opportunities for quality enhancement, and a well-equipped workforce. The following key drivers are instrumental in shaping the future of this sector:

1. High potential markets for export:

The Gulf Cooperation Council countries represent a prime market for Jordan's engineering services, primarily due to their focus on sustainability, strict environmental regulations and the scale of construction projects in nations such as the Kingdom of Saudi Arabia, Qatar and the United Arab Emirates. Additionally, the ongoing reconstruction and development initiatives in Iraq present substantial demand for environmental engineering and construction services, further amplifying the export potential for Jordanian firms in this sector.

2. High potential for quality improvement:

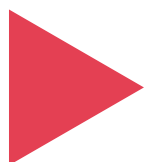
There is considerable scope to enhance the quality of engineering services in Jordan by embracing and integrating international best practices. Elevating service quality not only boosts the competitiveness of Jordanian firms but also enhances their reputation for excellence in engineering solutions. This, in turn, can attract more business opportunities both within the region and on a global scale, fostering growth and expanding the sector's reach.

3. Abundance of skilled engineers and technicians:

Jordan has a robust pool of skilled engineers and technicians, which is a key asset for the engineering services sector. By focusing on advancing the quality of engineering education and aligning training programmes with industry needs and global standards, Jordan can ensure a continuous supply of highly qualified professionals. This commitment to education and training is essential for meeting the evolving demands of the engineering services sector, thereby supporting sustained growth and long-term sustainability.



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5

► Business capability gaps

5.1 Engineering products sector

5.1.1 Insights from the STED workshop

The STED workshop highlighted several critical business capability gaps within the engineering products sector in Jordan, which are listed below:

1. **Development of trusting and dialogue-based industrial relations culture:** It is essential to improve structured collaboration between industry stakeholders, which is currently lacking.
2. **Health and safety standards:** Adhering to health and safety standards is very important, as it has a high impact on the sector's sustainability and worker well-being.
3. **Efficiency/costs/working capital requirements:** This indicates a need for better financial and operational management practices.
4. **Product improvement/product innovation:** These are areas requiring significant attention to remain competitive in the market
5. **Sourcing, developing the local supplier base, managing relationships with suppliers, ongoing purchasing operations, and managing source intermediaries:** There is a need for enhanced supplier management strategies.
6. **In-house logistics and after-sales services:** Better logistical planning and customer support mechanisms are required.

5.1.2 Findings from surveyed firms

The survey results add additional layers of understanding regarding business capability gaps in the sector. Many firms reported difficulties in expanding into the local market and highlighted challenges in developing the local supplier base and managing relationships with suppliers. Online shopping, logistics services and warehouse management emerged as significant areas needing improvement, reflecting the industry's struggle with digitalization and operational efficiency. Financial management and human resources management were consistently mentioned as critical gaps, indicating a widespread need for better financial oversight and workforce management. The survey also revealed that many companies are struggling with product management, quality management and the development of new products and processes, which are vital for sustaining growth and competitiveness.

A significant challenge facing Jordan's engineering sector is the lack of technological competence among firms, particularly SMEs. This aligns with the **efficiency, costs, and working capital requirements** identified in the STED workshop. Many firms are constrained by outdated technological infrastructure, which hampers their ability to adopt modern engineering practices. This gap is starkly evident in SMEs, where 52 per cent of surveyed firms reported inadequate technology as a major limitation. These technological deficiencies not only limit operational efficiency but also hinder the capacity for innovation and competitiveness in both local and international markets. For larger firms, while technology adoption is relatively better, there remains a constant need to upgrade and stay abreast of global technological advancements.

Moreover, effective management practices are critically lacking across the sector. This shortfall is particularly acute in areas such as project management, strategic planning and leadership. Survey data reveal that 46 per cent of firms highlighted a need for enhanced management training programmes to improve operational efficiency and drive growth. Poor management skills can lead to inefficiencies, misallocation of resources and an inability to respond promptly to market changes. Strengthening management capabilities is therefore essential for the overall growth and sustainability of the sector. This aligns with the workshop's focus on **developing a trusting and dialogue-based industrial relations culture** as a foundation for better management practices.

Innovation and R&D are also significantly underdeveloped, aligning with the workshop's emphasis on **product improvement and innovation**. Investment in R&D activities remains low, which adversely affects the sector's ability to innovate and remain competitive. Only 28 per cent of firms reported having dedicated R&D departments, and a concerning 35 per cent of respondents identified the absence of innovation as a critical gap. This lack of focus on innovation limits the ability of firms to develop new products, improve existing ones and explore new market opportunities. To bridge this gap, there needs to be a concerted effort to foster a culture of innovation, supported by adequate funding and infrastructure. This includes incentivizing R&D activities, enhancing collaboration between industry and academia, and creating supportive policies that encourage innovation-driven growth.

In addition to these core gaps, there are significant deficiencies in workforce skills and training. A notable 48 per cent of firms indicated that their employees lack the necessary technical skills to operate advanced machinery and software. This skills gap is particularly problematic as it impedes the ability of firms to maximize the use of existing technology and implement new processes. Addressing this requires comprehensive training programmes and continuous professional development initiatives to ensure the workforce is equipped with the latest skills and knowledge.

Another critical gap is the inadequate focus on sustainability and environmental practices. As global markets increasingly prioritize eco-friendly products and practices, Jordanian firms must adapt to these demands to remain competitive. However, 42 per cent of firms reported that they do not have any sustainability initiatives in place. This gap not only poses a risk to market access but also impacts the long-term viability of firms as environmental regulations become more stringent worldwide. Developing and implementing robust sustainability strategies will be crucial for firms to meet international standards and tap into new market opportunities.

Lastly, the sector faces challenges in accessing reliable market information and data analytics capabilities. Nearly 39 per cent of firms indicated that they lack the tools and expertise to analyse market trends and consumer behaviour effectively. This gap limits their ability to make informed strategic decisions and respond proactively to market shifts. Investing in market research capabilities and data analytics tools will enable firms to better understand their markets, optimize operations and enhance their competitive edge.



5.1.3 Summary of findings

The findings from the STED workshop and the survey results collectively highlight a critical need for enhanced technological competence, improved management practices and a stronger focus on innovation within Jordan's engineering sector. The STED workshop identified key challenges such as outdated technological infrastructure, inefficient management practices and a lack of emphasis on R&D, which are consistently mirrored in the survey data. Both sources reveal that SMEs face significant limitations due to inadequate technology and management skills, impeding their operational efficiency and growth potential. The survey further underscores the need for better financial and human resources management, as well as advancements in product and quality management. Additionally, the workshop's focus on fostering a culture of innovation aligns with the survey's findings on the low investment in R&D and the need for stronger sustainability practices. Together, these insights call for a comprehensive approach to address these overlapping gaps, emphasizing the development of technological capabilities, management training and innovation strategies to enhance the sector's competitiveness and sustainability.

5.2 Engineering services sector

5.2.1 Insights from the STED Workshop

The STED workshop highlighted critical business capability gaps within the engineering services sector in Jordan as follows:

1. **Quality assurance and quality control:** Firms struggle to implement robust quality assurance and quality control systems that meet international standards, affecting the reliability of services.
2. **Implementation of regulatory requirements:** There is a lack of integration of regulatory approvals and compliance management into business operations, leading to delays and inefficiencies.
3. **Community sustainable development:** The sector has limited engagement in sustainable development initiatives, affecting its social and environmental responsibilities.
4. **Development of a trusting and dialogue-based industrial relations culture:** Building a culture of trust and open communication between employers and employees is not well-established, leading to industrial relations challenges.
5. **Domestic market:** The engineering services sector is underdeveloped domestically, with limited focus on expanding local market opportunities.
6. **After-sales service:** Companies often neglect after-sales support, which is critical for maintaining customer satisfaction and long-term relationships.
7. **Regulatory affairs (approvals and management of compliance):** Managing regulatory compliance is cumbersome, with many firms struggling to keep up with the necessary approvals and requirements.
8. **Efficiency/costs/working capital requirements:** High costs and working capital demands place a strain on firms, reducing their operational efficiency and competitiveness.

- 9. Capabilities for effective communication with various stakeholders:** Firms lack the skills to communicate effectively with stakeholders, which hampers collaboration and project success.
- 10. Developing a local supplier base:** There is insufficient effort to cultivate and rely on local suppliers, which limits the sector's ability to build a resilient supply chain.
- 11. Occupational health and safety standards:** Adherence to occupational health and safety standards is inconsistent, putting workers at risk and exposing firms to potential liabilities.
- 12. Information technology systems, technology development and adaptation:** The sector is lagging in adopting modern information technology systems and technologies, hindering innovation and operational efficiency.
- 13. Sustainability governance:** Firms lack comprehensive sustainability governance practices, which are essential for long-term environmental and economic viability.

5.2.2 Findings from surveyed firms

The survey results reveal a significant disconnect between the competencies of engineering graduates and the actual needs of the labour market. Despite the high number of graduates entering the workforce, the skills they possess are not aligned with industry requirements, creating a substantial gap in technical and practical knowledge. This issue is compounded by a work culture that is predominantly driven by salaries, with little emphasis on professional growth, innovation or long-term career development. Consequently, the sector faces challenges in attracting and retaining talent, which in turn affects overall productivity and competitiveness.

5.2.3 Summary of findings

The STED workshop results reveal critical gaps in Jordan's engineering services sector. Key issues include inadequate quality assurance systems, poor integration of regulatory requirements and limited engagement in sustainable development. The sector also struggles with building a culture of trust in industrial relations, underdeveloped domestic markets and insufficient after-sales support. Firms face challenges with regulatory compliance, high costs and management of working capital, which affect their efficiency and competitiveness. Additionally, there are deficiencies in stakeholder communication, local supplier development, and occupational health and safety standards. The slow adoption of modern information technology systems and technology, along with weak sustainability governance, further hampers the sector's innovation and long-term viability. Addressing these issues is essential for improving overall performance and resilience.



► Skills implication of business capability gaps

6.1 Engineering products sector

The findings from the STED workshop highlighted key occupations in the engineering products sector in Jordan across various key functions. Participants identified a range of critical occupations essential for addressing these gaps and driving sectoral growth.

Processing: The sector's processing capabilities are directly influenced by the availability of skilled personnel. Industrial engineers and product development engineers are crucial for optimizing production processes and innovating new products, respectively. Additionally, the role of skilled operators and assemblers is vital in ensuring that production activities are carried out efficiently and to a high standard.

Installation and maintenance: In this function, maintenance engineers are identified as a key occupation, responsible for troubleshooting, and repairing and maintaining equipment to minimize downtime and ensure operational efficiency.

Quality assurance and control: Maintaining high standards of product quality is essential for competitiveness in the engineering sector. Quality control inspectors play a critical role in this area, ensuring that products meet the required specifications and standards before reaching the market.

Logistics and supply chain: The logistics and supply chain function is central to the timely and cost-effective delivery of products. Key occupations identified include supply chain managers, procurement managers, supply chain analysts and warehouse operatives. These roles are crucial for managing the flow of materials and finished products, optimizing inventory levels and ensuring that supply chain operations are efficient and resilient.

Environmental and safety: As sustainability becomes increasingly important, the need for roles focused on environmental and safety concerns has grown. Sustainability coordinators are essential in this regard, tasked with implementing and overseeing environmental practices within the sector to ensure compliance with regulations and contribute to long-term sustainability goals.

The STED workshops identified several key business capability gaps in the engineering products sector in Jordan, each with specific implications for the skills required to address these challenges effectively. The following are the critical gaps identified during the STED workshop:

1. Development of a trusting and dialogue-based industrial relations culture

One of the significant gaps identified is the need for a culture of trust and open communication within the industrial sector. To bridge this gap, there is a strong need for skills in value proposition, innovation and communication. These skills are essential for fostering a collaborative environment where all stakeholders can engage in constructive dialogue.

Main occupations affected: The occupations most affected are procurement managers and supply chain managers. These roles require the ability to build and maintain relationships with suppliers, partners and internal teams, necessitating strong communication and innovation skills to develop effective value propositions.

2. Health and safety standards

Another critical gap pertains to adherence to health and safety standards, which is crucial for maintaining a safe working environment. Addressing this gap requires skills in ISO 45001 standards.

Main occupations affected: The role most impacted by this gap is sustainability coordinator. This occupation requires a deep understanding of health and safety standards, particularly ISO 45001, along with the ability to plan and document safety measures to ensure a safe and compliant working environment.

3. Efficiency/costs/working capital requirements

The need to improve operational efficiency, manage costs and optimize working capital is another significant gap identified. Addressing this requires skills in lean manufacturing, just-in-time and costing. These skills are crucial for streamlining operations, reducing waste and enhancing overall productivity and profitability.

Main occupations affected: The occupation most affected by this gap is industrial engineer. This role demands expertise in lean manufacturing techniques and cost management to drive efficiency and support the financial health of the organization.

4. Product improvement/product innovation

Innovation and continuous product improvement are critical for maintaining competitiveness in the engineering products sector. To bridge this gap, the sector needs to enhance its R&D skills alongside business skills. These skills are vital for driving product innovation, developing new products and improving existing ones to meet evolving market demands.

Main occupations affected: The role most affected by this gap is the product development engineer. This position requires a combination of technical research and development skills, as well as a solid understanding of business strategies, to innovate effectively and bring new products to market.

5. Sourcing, developing the local supplier base, managing relationships with suppliers, overseeing ongoing purchasing operations, and managing source intermediaries

Effective sourcing and supplier management are essential for maintaining a reliable supply chain. Addressing this gap requires skills in market intelligence, sourcing, and enterprise resource planning systems. These skills are crucial for developing a strong local supplier base, managing relationships with suppliers and ensuring efficient purchasing operations.

Main occupations affected: The primary occupations impacted by this gap are procurement managers and industrial engineers. These roles need to be equipped with advanced sourcing techniques, market analysis capabilities and the ability to leverage enterprise resource planning systems to manage supplier relationships and streamline procurement processes.

6. In-house logistics and after-sales services

Efficient logistics and reliable after-sales services are key components of customer satisfaction and operational success. The skills required to address this gap include customer relationship management, communication skills, enterprise resource planning skills, and material handling expertise. These skills are necessary to ensure that logistics operations are smooth and that after-sales services meet customer expectations.

Main occupations affected: The occupations most affected by this gap include maintenance engineers, supply chain managers and warehouse operators. These roles must be proficient in managing in-house logistics, handling materials efficiently and providing excellent after-sales service, all while effectively communicating with customers and stakeholders.

In summary, the engineering products sector in Jordan faces several critical business capability gaps that must be addressed to ensure long-term growth and competitiveness. By developing the necessary skills in the affected occupations, the sector can overcome these challenges, leading to enhanced innovation, stronger supplier relationships, and improved logistics and after-sales services.

6.2 Engineering services sector

In the engineering services sector, the participants of the STED workshop identified several key occupations that are crucial for driving growth and innovation. These occupations span various functions, each playing a significant role in advancing the industry as follows:

Design and development emerged as a critical function, in which the roles of R&D engineer and HVAC design engineer (and design engineers in general) were highlighted. These professionals are essential for developing new products and improving existing ones, ensuring that companies remain competitive in the market.

Environmental compliance and sustainability and environmental and safety were also highlighted as critical functions, in which two key occupations were identified: environmental health and safety manager and sustainability coordinators. These roles are vital for ensuring that engineering products meet regulatory standards and contribute to sustainable practices, which are increasingly important in today's business environment.

The logistics and supply chain function is supported by supply chain managers, who are responsible for the efficient and effective movement of goods and materials, ensuring that products reach their intended markets on time and within budget.

Research and analysis are another critical functions, with occupations such as data analyst and laboratory technician being identified. These roles are crucial for gathering and interpreting data, which can inform decision-making and product development processes.

Finally, other important roles were identified, including application programmers (focused on information technology, programming and coding) and artificial intelligence engineers and designers (specializing in artificial intelligence design). These occupations are becoming increasingly important as the industry continues to integrate advanced technologies such as artificial intelligence into its processes and products.

In the engineering services sector, the STED workshop identified additional key business capability gaps that have important skills implications, affecting various occupations (as shown in table 24). These gaps highlight the need for enhanced expertise and competencies to ensure that the sector operates efficiently, safely and in alignment with market needs.

1. Quality assurance and quality control

The gap in quality assurance and quality control underscores the necessity for professionals to develop skills in setting specific, measurable, achievable, relevant and time-bound key performance indicators and gaining in-depth knowledge of ISO standards and certifications. These skills are essential for ensuring that products and services meet the highest quality standards, leading to improved customer satisfaction and compliance with international norms. The primary occupations affected by this gap include:

- supply chain managers
- logistics workers
- procurement specialists
- research scientists
- data analysts
- project managers
- construction managers
- environmental health and safety managers

2. Implementation of regulatory requirements

The ability to effectively implement and adhere to regulatory requirements is another critical capability gap identified. Professionals in this sector need a thorough understanding of current regulations and must be adaptable to changes in the regulatory landscape. This flexibility is crucial for maintaining compliance and avoiding legal or operational risks. The occupations most impacted by this gap include:

- environmental health and safety managers
- project managers
- R&D engineers
- product development engineers
- supply chain managers
- logistics workers

3. Community sustainable development

The gap in community sustainable development emphasizes the need for skills in planning, providing psychosocial support, implementing the Sustainable Development Goals (SDGs) and conducting effective monitoring and evaluation. These skills are essential for aligning business operations with broader societal and environmental goals, which are increasingly important for long-term sustainability. The roles most affected by this gap include:

- R&D engineers
- project managers
- environmental compliance officers
- supply chain managers

4. Efficiency/costs/working capital requirements

The gap related to efficiency, costs, and working capital requirements emphasizes the importance of professionals being proficient in using engineering programmes and applications. This skill is vital for optimizing design processes, reducing costs, and improving overall efficiency in project execution. The occupation most affected by this gap is:

- HVAC design engineers (and design engineers in general)

5. Developing a local supplier base

Local supplier base development is another significant gap, requiring skills in accessing local market needs, conducting relevant studies and possessing strong communication skills to engage effectively with customers. These capabilities are crucial for building and maintaining a robust local supply chain, which can reduce dependency on external suppliers and support the local economy. The occupation most impacted by this gap is:

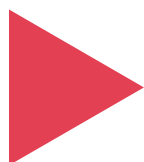
- supply chain managers

6. Occupational health and safety standards

The gap in occupational health and safety standards highlights the need for skills related to the safe handling of materials and tools in accordance with safety standards. Understanding the key steps for maintaining safety in the workplace is essential for preventing accidents and ensuring compliance with health and safety regulations. The role most affected by this gap is:

- laboratory technicians

More details of the business capability gaps can be found in Annex IV. By addressing these gaps through targeted skill development, the engineering services sector can enhance its operational effectiveness, safety, and responsiveness to local market demands, ensuring long-term growth and sustainability.



► Skills supply and mismatch

7.1 Engineering products sector

7.1.1 Education and training systems and programmes

7.1.1.1 Overview of the education system

Jordan's educational system comprises various levels of vocational, technical and higher education institutions that cater to the engineering sector. The education infrastructure includes technical schools, vocational training centres, community colleges and universities offering engineering programmes.

The Ministry of Education and the Ministry of Higher Education and Scientific Research oversee the education system, ensuring that it meets national standards and aligns with the country's economic needs. These ministries work to integrate TVET into the mainstream education system, emphasizing the importance of practical skills alongside theoretical knowledge.

Jordan's educational institutions focus on producing graduates who are well-equipped to meet the demands of the engineering sector. For instance, the Jordan University of Science and Technology and the University of Jordan are renowned for their rigorous engineering programmes, which cover various specializations such as civil, mechanical, electrical and industrial engineering. These universities emphasize both theoretical foundations and practical applications, preparing students to tackle real-world engineering challenges.

7.1.1.2 Training providers relevant for the sector

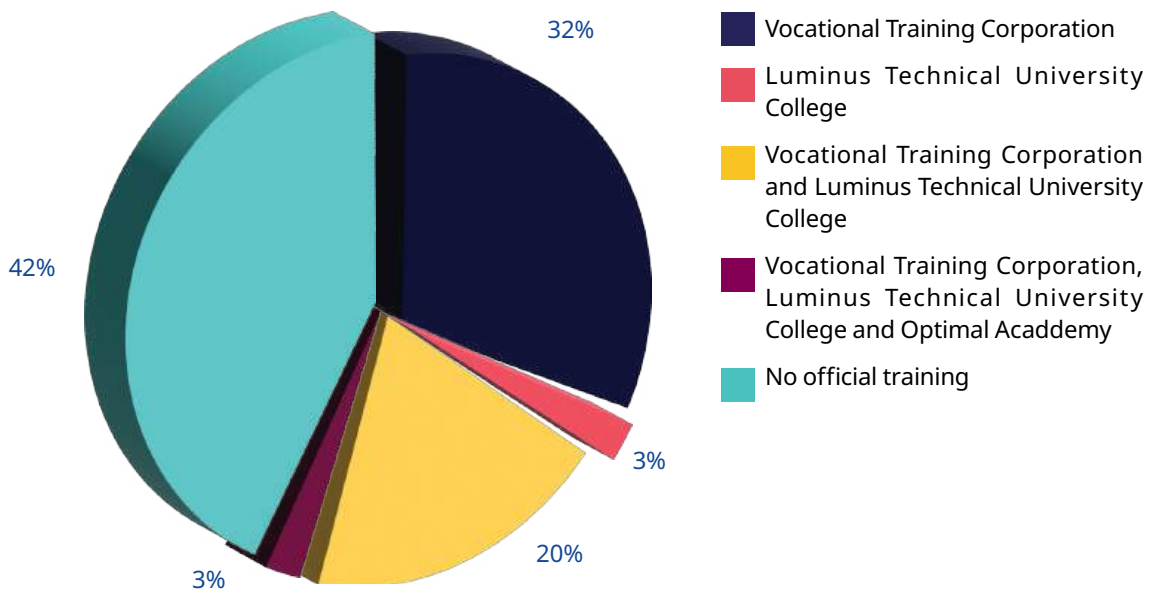
Key training providers in Jordan include the Vocational Training Corporation, the Jordan University of Science and Technology and the University of Jordan. These institutions offer a wide range of programmes tailored to the needs of the engineering sector, from basic technical training to advanced engineering degrees.

The Vocational Training Corporation provides hands-on training in various trades, including electrical, mechanical and civil engineering. It collaborates with industry partners to offer apprenticeships and on-the-job training, ensuring that graduates have practical experience. The Vocational Training Corporation has established partnerships with several local and international companies to ensure that their training programmes are aligned with industry standards and requirements.

According to the survey results, existing training programmes were praised for their role in upskilling the workforce, but stakeholders called for more specialized programmes that focus on emerging technologies and industry-specific skills.

The training providers for the engineering products sector are the Engineers Training Center - Jordan Engineers Association, the Vocational Training Corporation, the Luminus Technical University College and the Optimal Academy (for soft skills), as shown in figure 12.

► Figure 12



Source: Authors' survey [May 2024].

The Jordan University of Science and Technology and the University of Jordan offer comprehensive engineering programmes at undergraduate and postgraduate levels. These universities focus on R&D, contributing to innovation in the engineering sector. They also maintain strong industry linkages to facilitate internships, co-op programmes, and employment opportunities for their students. The Jordan University of Science and Technology, for example, has a dedicated career guidance and counselling centre that works closely with industry partners to place students in internships and full-time positions.

Additionally, private institutions and international organizations play a role in providing specialized training programmes. For instance, the German-Jordanian University offers a dual study programme that combines academic education with practical training in German and Jordanian companies, thus providing students with a unique blend of theoretical knowledge and practical skills.

7.1.1.3 Programmes on skills development

Several programmes aim to bridge the skills gap in the engineering products sector. These include:

1. **The National Employment and Training Programme:** Implemented by the Ministry of Labour, this programme focuses on equipping young Jordanians with the skills needed for employment in various sectors, including engineering. It offers training in both technical skills and soft skills such as communication and teamwork.
2. **Industry-academia partnerships:** Initiatives such as the partnership between the JCI and local universities aim to align educational programmes with industry needs. These partnerships facilitate curriculum development, guest lectures and collaborative research projects. For example, the partnership between the Jordan University of Science and Technology and the JEA includes the development of joint training programmes and research initiatives that address the specific needs of the engineering sector.

3. **Certification programmes:** Institutions such as the JSMO and international bodies offer certification programmes to ensure that engineering professionals meet international standards. These certifications enhance the employability of Jordanian engineers in global markets. For instance, the JSMO offers ISO certification courses that are highly regarded in the international engineering community.
4. **Continuous professional development:** Programmes offered by the JEA focus on the ongoing professional development of engineers. These programmes include workshops, seminars and short courses on the latest technological advancements and industry trends. The JEA also collaborates with international engineering bodies to offer globally recognized continuous professional development courses.
5. **Apprenticeships and internships:** Many engineering firms in Jordan offer apprenticeship and internship programmes to provide students with practical experience. For example, the collaboration between the German-Jordanian University and local industries ensures that students participate in dual studies, splitting their time between academic studies and practical training.
6. **Government and non-governmental organization initiatives:** Various government and non-governmental organizations run initiatives aimed at skills development in the engineering sector. For instance, USAID has funded several programmes to enhance vocational training and technical education in Jordan, focusing on areas such as renewable energy and sustainable engineering practices.
7. **Funding and scholarships:** There are numerous scholarships and funding opportunities available for students pursuing engineering degrees. These are provided by the Government, the private sector and international organizations. The Higher Education Council in Jordan, for example, offers scholarships for top-performing students to study engineering abroad and bring back advanced skills to the local market.
8. **Technology and innovation:** The integration of cutting-edge technologies and innovative practices in training programmes is crucial for developing a skilled engineering workforce. Institutions such as the Jordan University of Science and Technology and the University of Jordan have invested in state-of-the-art laboratories and research centres to facilitate advanced engineering education and research.

7.1.2 Recruitment

Recruitment within the engineering products sector in Jordan is carried out through a variety of channels, each serving to connect firms with potential candidates. The most popular method among firms is the use of online job portals, with approximately 60 per cent of firms indicating a preference for this approach due to its wide reach and efficiency in attracting diverse candidates. Additionally, about 35 per cent of firms engage in direct recruitment from vocational and technical schools, establishing partnerships with these institutions to secure a steady pipeline of newly trained talent. Job fairs and industry events also play a significant role, providing a platform for firms to meet prospective employees face to face and assess their skills and suitability for various roles.

Despite the diverse recruitment channels available, firms face significant challenges in attracting and retaining qualified candidates. A major obstacle is the prevalent skill gap, particularly for technical roles such as maintenance engineers and HVAC technicians. Survey data reveal that 48 per cent of firms reported difficulties in finding candidates with the requisite skills and experience, a situation exacerbated by the rapid technological advancements within the sector. This shortage of skilled labour underscores the need for enhanced training programmes and stronger collaboration between industry and educational institutions to align curricula with industry needs.

Retention of skilled workers presents another significant challenge for firms in the engineering sector. Competitive salaries and benefits are crucial for retaining talent, yet many firms, especially SMEs, struggle to offer packages that are attractive enough to prevent high turnover rates. This issue is particularly acute among younger employees and technicians, who often seek better opportunities elsewhere. Approximately 40 per cent of firms indicated that retaining skilled workers is a major concern, with many employees leaving due to inadequate compensation and limited career advancement opportunities.

Diversity and inclusion also pose challenges in the recruitment process. While efforts are being made to promote gender diversity and inclusivity within the sector, progress has been slow. The workforce in the engineering sector remains predominantly male, with only 25 per cent of firms reporting a balanced gender representation. Additionally, firms face difficulties in creating inclusive environments that attract and retain women and underrepresented groups. Enhancing diversity and inclusion requires targeted strategies and policies to ensure that all potential candidates have equal opportunities and support within the sector. Addressing these challenges is vital for fostering a competitive and innovative engineering workforce capable of driving Jordan's economic growth.

7.1.3 In-service training for existing employees

Investment in workforce training is a critical component for maintaining and enhancing the skills and productivity of employees within the engineering sector. However, the allocation of resources for training varies significantly between large enterprises and SMEs. Large firms, recognizing the importance of continuous skill development, allocate a substantial portion of their annual budgets to training programmes. On average, these enterprises invest around 5 per cent of their annual budgets in training, which translates to significant financial resources dedicated to employee development. In contrast, SMEs, constrained by limited financial resources, allocate approximately 2.5 per cent of their annual budgets to training programmes. This disparity in investment highlights the challenges that SMEs face in providing extensive training opportunities for their employees.

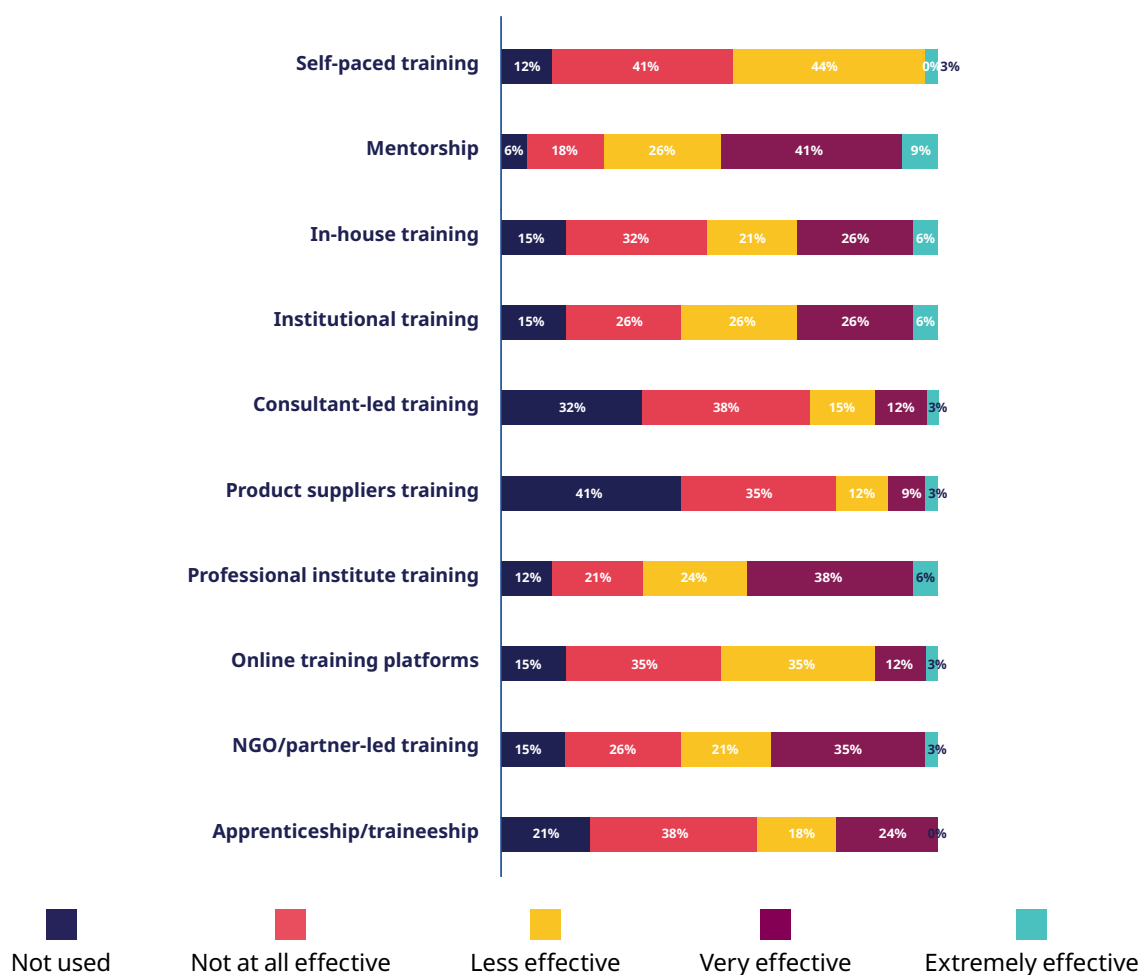
Time commitment to training also differs markedly between larger firms and SMEs. Larger firms are able to offer more comprehensive and structured training programmes, ensuring their employees receive sufficient time for skill development. Survey data indicate that about 70 per cent of large firms provide over 40 hours of training per employee annually, reflecting a strong commitment to continuous learning and development. In comparison, SMEs typically offer around 20 hours of training per employee annually, which may not be sufficient to keep pace with the rapidly evolving technological landscape and industry demands.

Key training providers for the engineering sector in Jordan include the Vocational Training Corporation, universities and private training institutes. The Vocational Training Corporation is particularly noted for its practical, hands-on training programmes, which are designed to equip workers with the technical skills required for various engineering roles. Universities, such as the Jordan University of Science and Technology and the University of Jordan, focus more on theoretical knowledge and research, offering comprehensive engineering programmes at undergraduate and postgraduate levels. These institutions play a crucial role in preparing the future workforce, although there is a need for greater integration of practical training to meet industry demands.

Despite the availability of training providers, firms in the engineering sector face several challenges in implementing effective training programmes. High costs associated with training programmes are a major barrier, with approximately 55 per cent of firms indicating that the expense is a significant hindrance. Additionally, there is a lack of relevant and updated training programmes that align with the specific needs of the engineering sector. This gap necessitates closer collaboration between training providers and industry stakeholders to develop curricula that address current and future skill requirements. Logistical issues, such as coordinating training schedules to minimize disruption to work, further complicate the implementation of training programmes. Firms must navigate these challenges to ensure that their workforce remains skilled and competitive in an increasingly complex and dynamic industry.

Surveyed firms in the engineering products sector rated “training by product supplier”, “training by outside consultants” and “training by education or training institutions” as the most effective training types (see figure 13).

► **Figure 13** **Types of training - Engineering products sector**



Source: Authors' survey [May 2024].

7.1.4 Skills shortages

The data reveal significant recruitment challenges across the engineering products sector. For raw material suppliers within the engineering products sector, the primary concerns were a lack of qualifications and suitable work experience, with both being considered significantly important by 56 per cent of respondents. Additionally, 89 per cent of respondents found the low number of motivated or work-minded applicants to be a critical issue. A shortage of candidates with the required skills and a lack of interest in the work were also significant, with 78 per cent and 67 per cent, respectively, highlighting these as major problems. Career development prospects were limited, with 56 per cent viewing this as fairly important. Unfavourable working conditions and pay were seen as very important by 56 per cent, and competition from other employers is equally pressing. Notably, the distance of work sites from suitable workers and the temporary nature of the work were also concerns, though less critical, with 44 per cent viewing location as not important at all.

For aggregators, 42 per cent and 26 per cent respectively saw the lack of qualifications and suitable work experience as significant issues. The low number of motivated applicants was a major challenge, with 79 per cent highlighting its importance. Similarly, the shortage of candidates with required skills was evenly split between fairly and very important. The lack of interest in this kind of work was a significant issue for 63 per cent, and career development prospects were a concern for 47 per cent. Unfavourable working conditions and competition from other employers are significant challenges, with 42 per cent and 47 per cent, respectively, finding these very important. The distance of work sites and the temporary nature of work were also notable concerns, though to a lesser degree.

Manufacturers in the engineering products sector face a unanimous consensus on the significance of all challenges, with 100 per cent of respondents finding every issue, from qualifications and work experience to motivation, skills and working conditions, significantly important. This highlights a critical area of concern needing urgent attention.

During the STED workshop, participants were asked which occupations had the most significant skills gaps in the engineering products sector (see table 12).

► **Table 12** **Key occupations with skills shortages in the engineering products sector**

Key occupations	Skills shortage (Yes/No)
Maintenance engineers	Yes
Warehouse operatives	No
Product development engineers	Yes
Industrial engineers	No

Source: Results of STED workshop held in July 2024.

The results indicate that maintenance engineers and product development engineers are occupations experiencing significant skills shortages, with participants acknowledging the lack of qualified professionals in these roles. However, occupations such as warehouse operatives and industrial engineers were not identified as facing significant skills shortages, suggesting a more stable supply of talent in these areas.

These findings align with the broader challenges highlighted earlier, emphasizing the need for targeted interventions to address the skills gap, particularly in specialized engineering roles. The convergence of survey data and workshop feedback underscores the importance of developing robust training and career development pathways to attract and retain talent in the engineering products sector.

7.1.5 Skills gaps

Addressing the skill gaps in Jordan's engineering sector is crucial for enhancing competitiveness, fostering innovation and driving sustainable growth. The sector faces several critical skills gaps that employers have identified, necessitating targeted interventions in training and development. This subsection examines the implications for skill requirements in both the engineering product sector and the engineering services sector.

7.1.5.1 Existing skills gaps identified by employers

Employers in both engineering products and services have consistently highlighted significant gaps in advanced technical skills. According to the survey data, 57 per cent of employers in the engineering products sector indicated a shortage of skills in automation and robotics, which are critical for modern manufacturing processes. Similarly, employers in the engineering services sector reported a lack of expertise in digital technologies, including data analytics and cybersecurity, which are essential for delivering cutting-edge solutions. Quality control emerged as a critical area for both sectors, with 45 per cent of employers identifying a need for improved skills to meet international standards and enhance product and service competitiveness.

7.1.5.2 Skills gaps arising from business capability gaps

The identified gaps in business capabilities have a direct impact on the skills required within both sectors. A significant number of firms indicated a need for enhanced skills in project management and strategic planning. Specifically, 43 per cent of employers in the engineering product sector highlighted that their workforce requires upskilling in project management to efficiently handle complex projects and improve overall operational efficiency. In the engineering services sector, strategic planning skills are also in demand, as 38 per cent of firms reported difficulties in long-term business planning and market positioning.

Furthermore, the low investment in R&D has translated into a need for skills in innovation management and advanced R&D techniques. Only 28 per cent of firms across both sectors have dedicated R&D departments, highlighting a critical gap that affects the ability to innovate. Consequently, there is a growing demand for skills in R&D management, with 36 per cent of employers emphasizing the need for training in this area to foster innovation and competitiveness.

7.1.5.3 Industry trends and entrepreneurial skills

Keeping pace with industry trends and fostering an entrepreneurial mindset is increasingly important for both engineering products and services sectors. Around 41 per cent of employers identified a need for skills in understanding and adapting to industry trends, such as sustainability practices and green technologies. These skills are essential for maintaining competitiveness in a market that is progressively leaning towards environmentally sustainable solutions.

Entrepreneurial skills are crucial, especially for SMEs looking to expand and innovate in both sectors. Approximately 37 per cent of firms reported a need for skills in entrepreneurship, including business development, financial planning and market analysis. These skills enable firms to identify new opportunities, secure funding and navigate the competitive landscape effectively.

7.1.5.4 Project management and strategic planning

Effective project management and strategic planning are vital for the successful execution of engineering projects and long-term business growth in both sectors. Survey data reveal that 43 per cent of firms require upskilling in project management to enhance their ability to manage resources, timelines and project deliverables efficiently. Moreover, strategic planning skills are necessary for firms to develop robust business strategies that align with market demands and drive sustainable growth.

7.1.5.5 Technical and soft skills development

For the engineering products sector, specific technical skills such as proficiency in computer-aided design, computer numerical control machining, and knowledge of HVAC systems are crucial. In the engineering services sector, expertise in environmental impact assessments, sustainable building practices and advanced construction techniques are in high demand. Soft skills such as communication, teamwork and problem-solving are universally essential across both sectors, facilitating better project coordination and client interactions.

Table 13 shows the skills gaps in the engineering products sector according to the STED workshop. Significant skills gaps were identified across various occupations, particularly among new entrants. Maintenance engineers, warehouse operatives, product development engineers and industrial engineers all show gaps in both technical skills and core work skills, including soft skills. Additionally, the existing workforce also faces challenges. Warehouse operatives and product development engineers exhibit gaps in their technical skills, while maintenance engineers and industrial engineers require upgrades to their current skill sets to meet evolving industry demands. These findings emphasize the need for focused training and development initiatives to bridge these gaps and enhance workforce capabilities.

► **Table 13** Occupations with the most significant skills gaps: Engineering products sector

Key occupations		Quality and relevance issues			
		Skills gaps of new entrants		Skills gaps of existing workforce	
		Technical skills	Core work skills/ soft skills	Technical skills	Core work skills/soft skills
1	Maintenance engineers	Yes	Yes	Need upgrading	No
2	Warehouse operatives	Yes	Yes	Yes	No – but not advanced
3	Product development engineers	Yes	Yes	Yes – no investment in skills	No - need development
4	Industrial engineers	Yes	Yes	Need upgrading	No

Source: Results of STED workshop held in July 2024.

The STED workshop and the survey conducted with firms in the engineering products and services sectors reveal a critical alignment in the identified skills gaps. Both sources underscore the pressing need for advanced technical skills, particularly in areas such as automation, robotics and digital technologies, which are essential for modern manufacturing and service delivery. Moreover, there is consensus on the importance of enhancing project management, strategic planning and innovation management skills, as these are pivotal for navigating complex projects and driving long-term business growth. The workshop also highlighted significant gaps among new entrants and existing workers, particularly in core technical and soft skills, reinforcing the need for comprehensive training programmes to address these deficiencies and bolster the overall competitiveness of Jordan's engineering sector.

7.1.6 Systematic constraints in the skills supply

In analysing the factors constraining the supply of the right skills from various educational and training sources, participants identified several key challenges. Funding and the relevance of curriculum and qualifications were consistently highlighted as critical issues. These constraints are particularly present in TVET colleges, universities, apprenticeships, and workplace training for employees. The lack of adequate funding severely limits the ability of these institutions to offer up-to-date programmes that align with industry needs. Furthermore, the relevance of the curriculum and qualifications provided by these institutions was seen as a major constraint, with participants noting that many programmes do not adequately prepare students or trainees for the demands of the engineering products sector. This misalignment between training and industry requirements contributes to the ongoing skills shortages observed in the sector.

► **Table 14** Constraints on skill supply sources: Engineering products sector

	TVET colleges	Universities	Apprenticeships	Workplace training for employees	Essence of the problem
National skills policy and strategy	0	0	0 – if mentioned	0 – if mentioned	-
Governance and stakeholder coordination	1	1	1	1	Poor or lack of dialogue
Funding	2	2	2	2	Private sector reluctance to invest Lack of public-private partnerships Absence of incentives
Relevance of curriculum and qualifications	2	2	2 – structured	2 – structured	No occupation standards or curriculum unification Absence of incentives (training and apprenticeships)
Delivery and assessment practices	1	2	2	1	Poor quality of delivery
Access to training for target groups	1	0	0	0	Awareness

Note: 0 = not a constraint; 1 = a constraint; 2 = a key constraint.

Source: Results of STED workshop held in July 2024.

7.2 Engineering services sector

7.2.1 Education and training systems and programmes

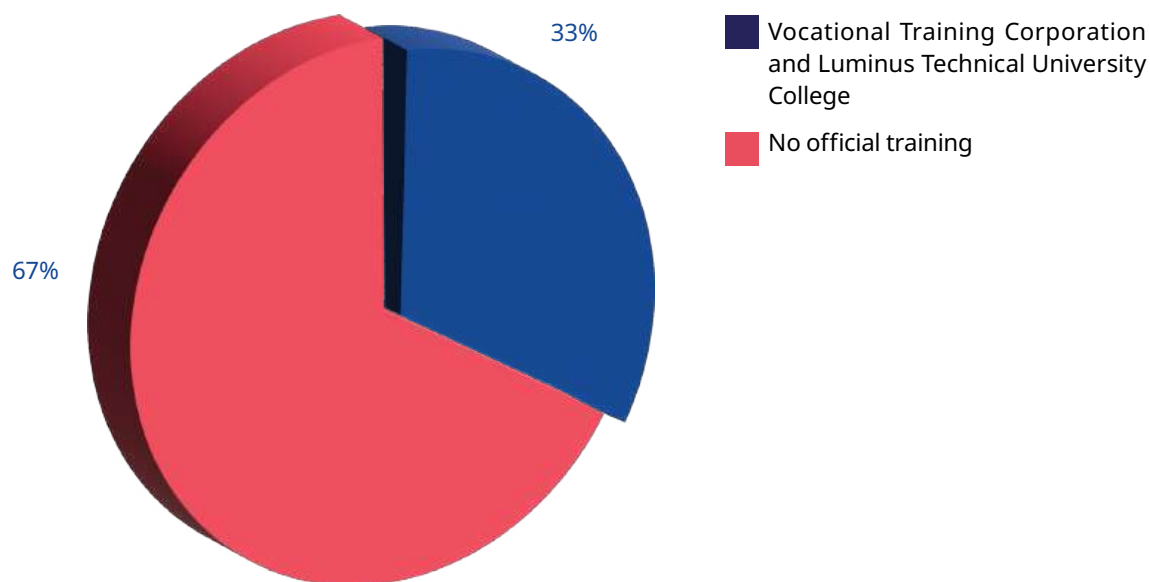
7.2.1.1 Overview of the education system

Similar to the engineering products sector, the engineering services sector in Jordan benefits from a comprehensive education system. The country's vocational, technical and higher education institutions, overseen by the Ministry of Education and the Ministry of Higher Education and Scientific Research, provide a range of programmes tailored to meet the sector's needs. Key institutions such as the Jordan University of Science and Technology and the University of Jordan offer rigorous engineering programmes that balance theoretical knowledge with practical skills, preparing graduates to address the engineering sector's challenges.

7.2.1.2 Training providers relevant for the sector

Key training providers in Jordan include the Vocational Training Corporation, the Jordan University of Science and Technology and the University of Jordan. These institutions offer a wide range of programmes tailored to the needs of the engineering services sector, from basic technical training to advanced engineering degrees.

► **Figure 14** Key training providers for engineering services



Source: Authors' survey [May 2024].

Figure 14 shows existing training programmes that have been acknowledged for their contributions to enhancing the workforce's skills. However, stakeholders have emphasized the need for more specialized programmes that address emerging technologies and industry-specific competencies.

- Survey data from firms indicated some interaction with formal training providers such as the Vocational Training Corporation and Luminus Technical University College. Nonetheless, many firms did not specify their training sources, revealing an opportunity to improve awareness about available training services and their advantages.
- The survey results also highlighted that firms consider “training by product supplier”, “employees undergoing training during their own time” and “apprenticeships and traineeships” as the most effective types of training.

7.2.1.3 Programmes on skills development

Several programmes aim to bridge the skills gap in the engineering services sector. These include ones similar to those mentioned above for the engineering products sector such as:

1. the National Employment and Training Programme
2. industry-academia partnerships
3. certification programmes
4. continuous professional development
5. apprenticeships and internships
6. government and non-governmental organization initiatives
7. funding and scholarships

7.2.2 Recruitment

In the engineering services sector, the recruitment system often revolves around project-based work. Employers frequently rely on referrals or prior experience with skilled workers from previous projects when seeking new hires. This approach helps maintain a pool of proven talent familiar with the specific demands of the sector.

Online job portals are the most commonly used channel for recruitment, preferred by approximately 63 per cent of firms for their broad reach and efficiency in attracting a diverse pool of candidates. Around 32 per cent of firms engage in direct recruitment from vocational and technical schools, forming partnerships with these institutions to ensure a steady influx of newly trained professionals. Job fairs and industry events also play a crucial role, offering opportunities for firms to meet candidates in person and evaluate their skills and fit for various positions.

Retention of skilled workers is another major challenge for firms in the engineering services sector. While competitive salaries and benefits are essential for retaining talent, many firms, especially SMEs, find it difficult to offer attractive compensation packages that prevent high turnover rates. This issue is particularly prevalent among younger employees and technicians, who often seek better opportunities elsewhere. Approximately 38 per cent of firms report that retaining skilled workers is a significant concern, with many employees leaving due to insufficient compensation and limited career advancement opportunities.

Diversity and inclusion in recruitment also present challenges. Efforts to promote gender diversity and inclusivity within the sector have shown slow progress. The workforce remains predominantly male, with only 30 per cent of firms reporting balanced gender representation. Additionally, firms face difficulties in creating inclusive environments that attract and retain women and underrepresented groups. Enhancing diversity and inclusion requires targeted strategies and policies to ensure equal opportunities and support for all potential candidates, which is crucial for fostering a competitive and innovative engineering workforce that can drive Jordan's economic growth.

7.2.3 In-service training for existing employees

Training and development are vital for enhancing the skills and productivity of employees in the engineering services sector. Large enterprises often allocate significant resources to training, recognizing its importance for ongoing skill development. These firms provide extensive training opportunities, allowing employees ample time to update their skills and keep pace with industry advancements.

In contrast, SMEs face challenges due to limited financial resources. They tend to invest less in training compared to larger firms, which can impact their ability to offer comprehensive development programmes. This disparity underscores the difficulties SMEs encounter in maintaining extensive training programmes.

Key training providers for the engineering services sector include the Vocational Training Corporation, universities and private training institutes. The Vocational Training Corporation focuses on practical, hands-on training, while universities such as the Jordan University of Science and Technology and the University of Jordan offer theoretical and research-based programmes. While these institutions are crucial for preparing the workforce, there is a need for greater integration of practical training to meet the sector's specific demands.

Challenges in training implementation include high costs and the need for training programmes to align more closely with industry requirements. Additionally, logistical issues, such as coordinating training schedules to avoid disrupting work, further complicate the process. Addressing these challenges is essential for ensuring that employees in the engineering services sector remain skilled and competitive.

7.2.4 Skills shortages

In the engineering services sector, raw material suppliers see a severe crisis in finding and retaining qualified and motivated employees. For processors, the concerns are more varied, with half finding qualifications, experience and motivation fairly important, and the other half viewing these as very important. The shortage of candidates with the required skills is equally split between fairly important and very important, while the lack of interest in this kind of work is seen as very important by all respondents. Career development prospects and unfavourable working conditions split opinions evenly between fairly and significantly important. Competition from other employers and the distant location of work sites are viewed as fairly important by half and very important by the other half. The temporary nature of work is also a critical issue, again splitting opinions between fairly and significantly important.

Overall, the data highlight a pervasive challenge in attracting and retaining a qualified and motivated workforce across both sectors. There is a critical need for interventions focused on skill development, improving working conditions and enhancing career prospects to address these issues effectively.

The responses from ecosystem players in the engineering sector highlight a variety of challenges in recruiting for their companies, emphasizing several critical issues that are pervasive throughout the industry. One of the most significant concerns is the clear weakness in basic engineering skills among recent graduates. This gap in fundamental knowledge and skills is not only present in new graduates but also among new employees, reflecting a systemic issue in the educational and training frameworks that feed into the engineering sector. The lack of basic competencies, such as computer skills and business management principles, further exacerbates this problem, making it difficult for companies to find suitable candidates who can meet the demands of modern engineering roles.

Additionally, the engineering sector is facing a pronounced skills shortage, particularly in specialized areas such as artificial intelligence and machine learning. This shortage extends to essential but less advanced skills, indicating a broad and deep gap in the talent pool. As technology rapidly evolves, the recruitment requirements within the engineering sector are also changing, making it necessary for companies to update and modernize their recruitment processes to stay competitive. This dynamic environment makes it even more challenging to attract and hire the right employees.

Compounding these difficulties is the intense competition for talent within the engineering sector. Companies are vying for a limited number of skilled professionals, which raises the stakes and makes recruitment highly competitive. This competition is heightened by the high expectations of highly skilled employees who demand substantial salaries, benefits and professional development opportunities. These expectations can be difficult to meet, especially for smaller firms or those with limited resources.

Moreover, there are concerns about the commitment to work requirements and the ability to find qualified and trained personnel. Many ecosystem players pointed out the lack of experience and job commitment among new recruits, which adds another layer of difficulty to the recruitment process. The quality of education and training outcomes is frequently cited as a root cause of these issues, indicating that the existing educational infrastructure may not be adequately preparing students for the realities of the engineering profession.

Finally, there is a noted difficulty in attracting qualified workers at all levels, from entry-level positions to more advanced roles. This difficulty is partly due to the weak basic skills among new employees and the lack of experience necessary to deal with complex engineering programmes and challenges. The combined effect of these factors creates a challenging environment for engineering companies seeking to build and maintain a capable and committed workforce.

In summary, the ecosystem players identified a range of challenges in recruiting for the engineering sector, including a fundamental skills gap, a shortage of specialized talent, intense competition for skilled workers, rapidly changing recruitment requirements, and high expectations from potential employees. Addressing these challenges will require concerted efforts to improve educational outcomes, update recruitment processes, and create supportive environments that can attract and retain the necessary talent to drive the sector forward.

Summary of the main recruitment challenges:

- **Skills gap:** There is a pervasive gap in basic and advanced skills among recent graduates and new employees, affecting all subsectors.
- **Motivation and job commitment:** A significant number of companies highlight the lack of motivated and work-minded applicants as a critical challenge.
- **Competition for talent:** Intense competition among employers for a limited talent pool, particularly for specialized skills in emerging technologies.
- **Changing recruitment requirements:** Rapid technological advancements necessitate updated recruitment processes, posing a challenge for companies to keep up.
- **High expectations from employees:** The high expectations of potential employees regarding salary, benefits and professional development opportunities are challenging to meet.
- **Unfavourable working conditions:** Poor working conditions and inadequate pay are major deterrents for attracting qualified candidates.
- **Location and nature of work:** The distant location of work sites and the temporary nature of job offers are additional factors hindering recruitment efforts.

During the STED workshop, participants were asked which occupations had the most significant skills gaps in the engineering services sector (see table 15).

► **Table 15** Key occupations with skills shortages in the engineering services sector

Key occupations		Skills shortage (Yes/No)
1	Data analysts	Yes
2	Supply chain managers	No
3	R&D engineers	Yes
4	Environmental health and safety manager	Yes
5	Sustainability coordinators	Yes
6	HVAC design engineers (design engineers in general)	Yes
7	Supply chain managers	Yes
8	Laboratory technicians	Yes

Source: Results of STED workshop held in July 2024.

The results indicate that data analysts, R&D engineers, environmental health and safety managers, sustainability coordinators, HVAC design engineers (design engineers in general) and laboratory technicians are occupations experiencing significant skills shortages, with participants acknowledging the lack of qualified professionals in these roles. However, the occupation of supply chain manager was not identified as facing significant skills shortages, suggesting a more stable supply of talent in that area.

In conclusion, the interconnected findings from quantitative data, qualitative responses and key informant interviews illustrate a comprehensive range of challenges in recruiting a qualified workforce in the engineering sector. Addressing these issues requires concerted efforts to enhance educational outcomes, modernize recruitment processes, improve working conditions, and provide competitive compensation and career development opportunities. Only through such multifaceted interventions can the engineering sector hope to attract and retain the necessary talent to drive innovation and growth.

7.2.5 Skills gaps

Addressing the skill gaps in Jordan's engineering services sector is crucial for enhancing competitiveness, fostering innovation and driving sustainable growth. The sector faces several critical skills gaps that employers have identified, necessitating targeted interventions in training and development, as mentioned in the subsection on the engineering products sector.

Table 16 summarizes the results from the STED workshop, highlighting key occupations with significant skills gaps and quality/relevance issues. The focus is on identifying which occupations face the most pressing challenges in terms of skills shortages, quality and relevance of skills, and specific gaps in both technical and core work skills.

► **Table 16** Occupations with most significant skills gaps: Engineering services sector

Key occupations		Quality and relevance issues			
		Skills gaps of new entrants		Skills gaps of existing workforce	
		Technical skills	Core work skills/soft skills	Technical skills	Core work skills/soft skills
1	Data analysts	Yes	Yes	Yes	Yes
2	Supply chain managers	Yes	No	No	No
3	R&D engineers	Yes	Yes	Yes	Yes
4	Environmental health and safety managers	Yes	Yes	Yes	Yes
5	Sustainability coordinators	Yes	Yes	No	No
6	HVAC design engineer (design engineers in general)	Yes	Yes	No	Yes
7	Supply chain managers	Yes	Yes	No	Yes
8	Laboratory technicians	Yes	NA	No	Yes

Source: Results of STED workshop held in July 2024.

- **Data analysts** face substantial challenges due to both a lack of relevant skills and issues with the quality and relevance of existing skills. New entrants and the current workforce alike exhibit significant gaps in technical skills and core work skills, indicating a critical need for enhanced training and development programmes to bridge these deficiencies.
- **R&D engineers** also encounter considerable difficulties. There are clear gaps in technical and core work skills for both new entrants and the existing workforce, compounded by issues related to the quality and relevance of these skills. This highlights an urgent need for more comprehensive educational and training resources to support this vital role.
- **Environmental health and safety managers** experience significant skill gaps, with both technical and core work skills lacking for new entrants and the current workforce. Quality and relevance issues further exacerbate these gaps, suggesting that targeted improvements in training and professional development are essential to address these challenges effectively.
- **Sustainability coordinators** show notable gaps in technical skills among new entrants, although core work skills do not present significant issues. The overall quality and relevance of the skills in this role need enhancement to better meet current demands.
- **HVAC design engineers** face substantial gaps in technical skills, especially among new entrants. Despite this, core work skills appear to be less problematic. Quality and relevance issues indicate a need for improved training initiatives to better align with industry standards.
- **Supply chain managers**, including new entrants and the existing workforce, encounter significant technical and core work skill gaps. For the existing workforce, these issues are more pronounced, highlighting the need for focused upskilling and professional development to address these critical areas.
- **Laboratory technicians** experience a lack of technical skills, particularly within the existing workforce. While there is no data on new entrants, the need for targeted skill development in this area is evident to ensure proficiency and relevance in laboratory settings.

The quantitative and qualitative survey data further highlight essential technical and soft skills required across the sector. Firms have identified critical technical skills, including sustainability, engineering design, and expertise in solar and wind power. Additionally, there is a strong emphasis on soft skills such as customer services, effective communication, leadership and adaptability. These findings underscore the importance of addressing skill gaps to enhance the sector's overall competitiveness, foster innovation and support sustainable growth.

The results from the STED workshop reveal significant skills gaps in Jordan's engineering services sector, particularly among key technical roles such as data analysts, R&D engineers and environmental health and safety managers. These occupations exhibit deficiencies in both technical and soft skills, affecting both new entrants and the existing workforce. Issues related to the quality and relevance of skills are also prevalent, indicating a need for targeted interventions in training and development to better align workforce capabilities with industry demands.

7.2.6 Systematic constraints in the skills supply

► Table 17 Constraints on skill supply sources: Engineering services sector

	TVET colleges	Universities	Apprenticeships	Workplace training for employees	Essence of the problem
National skills policy and strategy	2	0	2	2	Lack of concrete policies for TVET
Governance and stakeholder coordination	1	1	2	2	Poor internal and external coordination
Funding	1	2	2	2	Lack of sustainability, poor distribution of funding
Relevance of curriculum and qualifications	1	1	2	2	Need for updating
Delivery and assessment practices	0	1	2	2	Lack of standard methodology for assessment
Access to training for target groups	2	1	1	1	Limited number of training places for TVET; even after launching the Business and Technology Education Council (BTEC) programme

Note: 0 = not a constraint; 1 = a constraint; 2 = a key constraint.

Source: Results of STED workshop held in July 2024.

The engineering services sector faces multiple constraints that hinder the effective supply of skills, impacting various training sources such as TVET colleges, apprenticeships, universities and workplace training. These challenges are highlighted above in table 17, which details the specific limitations affecting the sector as follows:

The **national skills policy and strategy** is a significant constraint across multiple training sources. TVET colleges, apprenticeships, and workplace training for employees are all heavily affected due to the lack of concrete policies specific to TVET. This indicates that inadequate policy frameworks are impeding the effective development and alignment of skills training programmes.

Governance and stakeholder coordination present a notable constraint, particularly impacting apprenticeships and workplace training. Poor internal and external coordination complicates the alignment of training programmes with industry needs and reduces the effectiveness of skill development initiatives across these platforms.

Funding is identified as a key constraint, especially for universities and apprenticeships. The sustainability and distribution of funds are major issues, affecting the capacity of these institutions to deliver relevant and effective training programmes. This constraint underscores the need for better financial strategies and resource allocation to support skill development.

The **relevance of curriculum and qualifications** is also a significant issue, particularly for apprenticeships and workplace training. There is a pressing need to update and align curricula and qualifications with current industry requirements to ensure that the training provided meets the evolving demands of the job market.

Delivery and assessment practices are less of a constraint for TVET colleges but remain a concern for universities and workplace training. There is a need for standardized methodologies in assessment practices to ensure consistency and effectiveness in evaluating and validating skills.

Access to training for target groups is a major constraint for TVET colleges, with limited training places being a key issue. Although the launch of the Business and Technology Education Council (BTEC) programme may address some of these limitations, the overall access to training remains a challenge that needs to be addressed to expand opportunities for target groups.

► **Table 18** Collaboration between employers and providers of education and training established in the sector: Engineering services sector

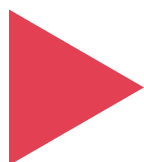
	TVET colleges and centres (public and private)	Universities (public and private)	Other training providers **	Barriers
Internships and other work-based learning	2	1	1	NA
Workplace experience for trainers/educators	1	0	1	Lack of capacity and preparation
Employees participate in mainstream courses away from workplace	1	1	0	Lack of/Inadequate funding
Train-the-trainer and train-the-mentor courses for workplace trainers, managers etc.	1	2	0	Lack of training and communication skills

Note: 0 = no collaboration; 1 = some collaboration; 2 = strong collaboration

Source: Results of STED workshop held in July 2024.

As detailed in table 18, the engineering services sector exhibits varying levels of collaboration between employers and educational and training providers. While there are robust partnerships, particularly with TVET colleges in areas such as internships and work-based learning, other aspects such as workplace experience for trainers and broader engagement with universities and other training providers present significant challenges. These collaborative efforts are crucial for aligning educational outcomes with industry needs and improving the sector's overall training effectiveness, but there remain key areas that require further attention:

- **Collaboration between employers and TVET colleges and centres** is strong, particularly with respect to internships and work-based learning opportunities. This indicates a robust partnership where practical experiences are integrated into the training process, enhancing the relevance and applicability of the skills learned. However, collaboration on workplace experience for trainers and educators is less effective, primarily due to capacity and preparation issues.
- **Universities** show a moderate level of collaboration with employers, especially in areas like train-the-trainer courses. This reflects a decent partnership that supports the development of trainers and mentors, although there is room for improvement. In contrast, the collaboration in providing workplace experience for trainers and educators is notably weak, largely due to limitations in capacity and preparation.
- **Other training providers** exhibit a more limited collaboration with employers, particularly in internships and work-based learning, and the involvement in mainstream courses away from the workplace. The lack of strong collaboration here may be attributed to inadequate funding, which restricts the capacity to offer and support these training opportunities effectively.
- **Barriers to effective collaboration** include issues related to capacity and preparation for workplace experience for trainers, and insufficient funding affecting the participation of employees in mainstream courses. Additionally, the lack of training and communication skills for train-the-trainer and train-the-mentor programmes hampers the effectiveness of these training initiatives.
- Overall, while there are strong collaborative efforts in certain areas like internships with TVET colleges, there are significant barriers in other areas that need to be addressed to improve the overall integration and effectiveness of training programmes in the engineering services sector.



► Recommendations for responding to future skills needs

To support Jordan's engineering products and services sectors and drive economic and trade diversification, it is essential to develop skills, taking into consideration industry demands, which should strengthen the business capabilities of the two sectors. Below is a summary of the recommendations developed through the STED workshop.

8.1 Engineering products sector

8.1.1 Improvement of core skills required for industrial engineers

The first proposal emphasized the need for a 6–12-month training programme to enhance the core technical skills of industrial engineers. This programme would involve senior industrial engineers from top engineering factories coaching junior industrial engineers, ensuring the transfer of practical and technical knowledge. Beneficiaries would include industry business owners and junior industrial engineers, with the programme being managed by the Chambers of Industry in each governorate and the JEA. The training would be conducted in partnership with both large firms and SMEs.

8.1.2 Development of a tax incentive programme for R&D and innovation

Another proposal focused on improving and enhancing products for export through the implementation of tax incentive programmes. These incentives would support companies in their R&D and innovation efforts, thereby boosting the competitiveness of local products in international markets. This initiative would be led by the Chambers of Industry, relevant ministries, and R&D councils to provide effective support and guidance to companies.

8.1.3 Improvement of warehouse operation skills

Participants proposed the creation of a formal training programme for warehouse operators, particularly those in SMEs, to address their lack of scientific knowledge. Although these operators have experience and often rely on memory for their daily tasks, formal training would enhance their efficiency and accuracy. This programme is expected to be organized and supervised by the JCI.

8.2 Engineering services sector

8.2.1 Improving the skills of laboratory technicians

Participants proposed enhancing the technical skills and safety awareness of lab technicians in the engineering services sector through integrated training programmes lasting two years. The training should be delivered by Jordanian universities and accredited engineering laboratories under the supervision of the Ministry of Public Works and Housing.

8.2.2 Improving supply chain management skills

To improve supply chain efficiency, participants suggested a training programme for supply chain managers focusing on export/import operations. This programme could be facilitated by the Jordanian Customs Department, university training centres and the Chambers of Industry and Commerce.

8.2.3 Improving the skills required for HVAC design engineers

Participants proposed a training programme aimed at improving the skills of HVAC design engineers, particularly in designing and preparing specifications for cooling systems. The programme should include theoretical lessons and 6-month work-based learning experiences, with training provided by engineering offices and training centres to benefit both students and on-the-job professionals.

8.3 Recommendations for both sectors

Below are recommendations from the authors of this report based on the results of survey and qualitative interviews, which complement the proposals resulting from the STED workshop listed above.

8.3.1 Strengthening of the business capabilities of SMEs in the engineering sector

To strengthen the business capabilities of SMEs in Jordan's engineering products and engineering services sectors, the following policy recommendations are suggested:

8.3.1.1 Engineering products policy recommendations

Enhance technological competences

Both the survey responses and the key informant interviews pointed to an urgent need for technological upgrades to improve productivity and reduce costs. The STED workshop discussions emphasized that, without these upgrades, SMEs will struggle to compete, particularly in export markets where efficiency and product quality are critical.

- **Subsidize technological upgrades:** Provide financial incentives, such as grants or low-interest loans, to SMEs for upgrading their technological infrastructure. The survey and key informant interviews revealed that outdated technology is a major constraint for SMEs in the engineering products sector. This proposal addresses the need for information technology systems, technology development, and adaptation (as identified by the STED workshop). By providing financial incentives, such as grants or low-interest loans, SMEs can upgrade their technological infrastructure, enabling them to enhance production efficiency and product quality
- **Technology adoption programmes:** Establish government-backed programmes to support the adoption of modern engineering technologies, including automation, 3D printing and robotics. The STED workshop highlighted the need for the engineering products sector to integrate cutting-edge technologies. Government-backed programmes will facilitate the adoption of essential technologies such as robotics, ensuring that SMEs can innovate and improve production efficiency, thereby addressing the constraints of technological lag in this sector.

Improve management practices

The survey and key informant interviews revealed that many SMEs struggle with inefficient management practices, which negatively impact their operational efficiency and financial performance. The STED workshop findings confirmed that better management training and mentorship are needed to address these challenges.

- **Management training programmes:** Develop and offer comprehensive management training programmes focusing on project management, strategic planning and leadership. The STED workshop revealed that modern management practices, including strategic planning and project management, are crucial for operational efficiency in the engineering products sector, particularly in areas such as efficiency, cost management, and working capital requirements (highlighted by STED workshop participants working in the engineering products and services sector). With 46 per cent of surveyed companies indicating a lack of effective management, targeted training will directly address this challenge.
- **Mentorship and coaching:** Facilitate mentorship and coaching opportunities by pairing SMEs with experienced industry leaders and successful entrepreneurs. SMEs often lack access to experienced mentors, as noted in the survey and key informant interviews. Drawing on insights from the STED workshop, which emphasized leadership development in the engineering products and services sectors, participants highlighted the importance of strengthening local supplier bases and enhancing skills in supplier relationship management. This recommendation aims to bridge the gap in management skills by providing mentorship opportunities that can guide SMEs in the engineering products sector toward better business practices. Mentorship and coaching programmes will facilitate knowledge transfer and capacity building, enabling SMEs to build stronger supplier relationships and improve overall management practices.

Foster innovation and R&D

The survey and key informant interviews identified innovation as a key driver for growth, but SMEs often lack the resources or incentives to invest in R&D. The STED workshop findings emphasized the need for collaboration and support to foster a culture of innovation in the sector.

- **R&D and tax incentives:** Provide tax incentives for companies investing in R&D activities. Innovation was identified as a critical factor during the STED workshop, with the lack of R&D investment seen as a barrier to product development and competitiveness. Offering tax incentives for R&D activities will stimulate innovation in product design and manufacturing processes within the engineering products sector. This recommendation is aimed at encouraging SMEs to invest in innovation, addressing the gap in product improvement and innovation identified during the STED workshop. Tax incentives will reduce the financial burden of R&D activities, allowing SMEs to focus on developing new products and improving existing ones.
- **Industry-academia collaboration:** Promote partnerships between industry and academia to drive innovation through joint research projects and internships. The survey results and key informant interviews highlighted the lack of collaboration between industry and academia, which hampers innovation. This recommendation promotes partnerships to bridge the gap between theoretical research and practical application, driving innovation in product development.
- **Innovation grants:** Establish grants to fund SMEs' innovative projects, including product development and process improvements.

Promote health and safety standards

Poor health and safety standards were frequently cited in the survey and key informant interviews as barriers to both worker retention and productivity. Ensuring that SMEs comply with safety regulations will improve working conditions and operational efficiency

- **Occupational health and safety training:** Addressing the gap in health and safety standards identified by groups 1 and 3 during the STED workshop, this recommendation proposes targeted training programmes to ensure compliance with occupational safety regulations. The survey and key informant interviews also highlighted that inadequate health and safety measures are a significant concern for both workers and businesses. Additionally, according to the survey, only 6 per cent of companies in the engineering industries reported compliance with Occupational Safety and Health Administration regulations, and 19 per cent highlighted concerns over the lack of reporting mechanisms for safety issues. Many workers face long hours, physically demanding tasks and exposure to hazardous environments. The provision of personal protective equipment and regular safety training is limited, with only 3–10 per cent of companies reporting that these are part of their regular safety protocols.

8.3.1.2 Engineering services policy recommendations

Enhance technological competences

Both the survey responses and the key informant interviews confirmed that the engineering services sector needs to embrace modern technology to remain competitive. The STED workshop further emphasized that technological adoption is essential for improving service delivery and client satisfaction.

- **Technology adoption programmes:** Similar to the engineering products sector, the services sector faces challenges with outdated technology, as highlighted in both the survey and the key informant interviews. This recommendation addresses the need for information technology systems, technology development and adaptation (as identified by group 3 in the STED workshop). Government-backed programmes will help service-oriented SMEs adopt modern technologies that improve efficiency in project management, design and delivery.
- **Improve management best practices:** Create a platform for sharing management best practices and success stories to encourage continuous improvement such as management training programmes and mentorship and coaching. The survey and key informant interview findings consistently pointed to poor management practices as a barrier to growth in the services sector. The workshop findings supported this, stressing the importance of improving management practices and industrial relations.

Enhance recruitment processes

- **Modernized recruitment strategies:** Encourage engineering companies to adopt modern recruitment tools and techniques, such as artificial intelligence-driven talent acquisition platforms, to streamline the hiring process and identify the best candidates efficiently.
- **Employer branding:** Support companies in building strong employer brands that attract top talent. This includes promoting a positive work culture, competitive compensation packages, and opportunities for career growth. According to the survey, 56 per cent of respondents reported significant recruitment challenges due to unfavourable working conditions, competition from other competitive companies, and retention of qualified and motivated employees.

- **Talent retention programmes:** Develop initiatives aimed at retaining skilled employees, such as mentorship programmes, career progression pathways, and employee engagement activities. This will help reduce turnover rates and maintain a stable workforce.

Improve working conditions

- **Competitive compensation and benefits:** Encourage companies to offer competitive salaries, comprehensive benefits packages, and performance-based incentives to attract and retain top talent. According to the survey, pay scales often do not reflect the level of skill and effort required for these roles, leading to dissatisfaction and high turnover rates. For instance, wages are often below industry standards, with minimal benefits, and overtime compensation is either insufficient or non-existent.

8.3.1.3 Cross-cutting recommendations to strengthen the business capabilities of SMEs in the engineering sector

Based on the comprehensive analysis of the challenges and opportunities in Jordan's engineering sector, the following policy recommendations aim to enhance market access, financial stability, regulatory efficiency, operational capabilities, and workforce development to boost sales in both the engineering products (air conditioning) and engineering services sectors.

Develop supplier relationships

The survey and key informant interviews revealed that SMEs struggle with supplier management, which impacts their ability to maintain consistent production quality and timelines. Strengthening supplier relationships will improve overall business performance and competitiveness.

- **Supplier development programmes:** This recommendation addresses the capability gap in sourcing and developing local suppliers (identified by group 1 and group 3 in the workshop). By supporting SMEs in building strong local supply chains and managing supplier relationships effectively, this policy will enhance their operational resilience and reduce costs.

Promote sustainability and environmental practices

Sustainability was a recurring theme in the survey, key informant interview and workshop findings, with many SMEs recognizing the need to adopt environmentally friendly practices to remain competitive. Providing support for green technology adoption will help SMEs reduce their environmental impact and attract eco-conscious clients

- **Sustainability standards:** The workshop findings emphasized the importance of sustainability governance and community sustainable development (highlighted by groups 2 and 3). Developing sustainability standards and supporting SMEs in meeting these standards will ensure that firms across both sectors can remain competitive in a market increasingly focused on eco-friendly and sustainable solutions
- **Green technology grants:** This recommendation supports the adoption of green technologies, in line with the sustainability priorities identified in the survey, key informant interviews and workshop discussions.

Enhance market information and data analytics

Both the survey and the key informant interviews highlighted that many SMEs lack access to critical market information, limiting their ability to make informed strategic decisions. Supporting market research initiatives will help bridge this gap and improve market positioning.

- **Market research support:** Offer support for market research initiatives, including funding and access to market research databases. Addressing the gaps in quality assurance, regulatory compliance and market development identified during the workshop, this recommendation focuses on providing SMEs with the necessary data and insights to better understand consumer trends, ensure compliance with international standards, and enhance their competitiveness.

Increase market access

- **Leverage existing free trade agreements:** Enhance the utilization of existing free trade agreements by providing targeted support to companies on how to fully benefit from these agreements. This includes offering guidance on tariff reductions, preferential market access, and compliance with rules of origin in free trade agreements. This recommendation encourages the conduct of workshops and training sessions to educate businesses about the practical benefits and strategic use of current free trade agreements, helping them to maximize their competitive advantage and expand their export opportunities.
- **Expand trade agreements:** Strengthen and negotiate additional free trade agreements, particularly targeting the Gulf Cooperation Council countries, China, Germany and the United States.
- **Promote compliance:** Support companies in meeting international quality standards (CE marking and ISO certification) to facilitate exports.
- **Market penetration:** Organize trade missions, exhibitions, and business-to-business matchmaking events to increase visibility and market penetration in high-potential markets such as Iraq and the Kingdom of Saudi Arabia.

Market awareness and customer engagement

- **Customer education:** Launch awareness campaigns highlighting the benefits of energy-efficient and environmentally friendly engineering products and services.
- **Customer linkages:** Strengthen customer linkages through networking events, industry forums and digital platforms to enhance business relationships and market reach.

8.3.2 Enhancement of skills development for inclusive sectoral growth

Realign engineering education and training programmes with current and future industry needs

- Actively promote science, technology, engineering and mathematics (STEM) education from early stages to build a strong foundation for aspiring engineers, thereby cultivating a pool of talent that is well-prepared to drive innovation and advancement in the engineering sector.
- Create strategic partnerships between educational institutions and industries to establish internship programmes and co-op education models, offering students valuable hands-on experience and industry exposure, thus bridging the gap between academia and real-world applications.

- ▶ Update engineering curricula in universities and technical institutes to incorporate the latest technologies and methodologies in engineering products and services.
- ▶ Launch campaigns to emphasize the importance of engineering in national development and the career opportunities it offers.
- ▶ Organize engineering career fairs and expos to connect students and job seekers with potential employers and training providers.
- ▶ Implement community outreach programmes to encourage interest in engineering among underrepresented groups and communities.

Provide continuous learning and upskilling opportunities for the current workforce

- ▶ Collaborate with key industry professionals to set up specialized technical training centres focusing on key engineering sectors such as HVAC, environmental engineering, and renewable energy technologies.
- ▶ Develop certification programmes in collaboration with industry stakeholders to ensure that the workforce remains proficient in current and emerging technologies.
- ▶ Foster partnerships between industry, training centres and certification bodies to encourage SMEs to integrate more educational programmes into their employment practices and become better equipped.

8.3.3 Promotion of decent work for women and youth

Enhance labour right awareness and protection

- ▶ Raise awareness about labour rights among women and youth, including fair wages, safe working conditions and anti-discrimination laws.
- ▶ Implement programmes to ensure that workers are aware of and can access legal resources and support.

Align industry needs with government policies

- ▶ Develop partnerships between government agencies, industry players and educational institutions to create job opportunities and training programmes for women and youth.
- ▶ Launch government-sponsored employment programmes targeting women and youth, providing job placement services and on-the-job training.

Create work environments that support women and youth

- ▶ Encourage flexible working hours, remote work options and part-time positions to accommodate diverse needs.
- ▶ Promote family-friendly workplace policies such as parental leave, childcare support and health benefits.

Ensure equal opportunities for women and youth in engineering sectors

- Implement diversity and inclusion programmes within companies to foster a supportive work environment.
- Provide tax incentives and grants to companies that hire and retain women and youth in engineering roles.

8.3.4 Enhancement of coordination between tripartite and social partners**Ensure effective coordination and decision-making**

- Form advisory boards comprising representatives from the Government, industry, academia, and professional organizations to oversee the implementation of recommendations.
- Establish coordination committees to manage specific projects and initiatives, ensuring alignment with overall sectoral goals and policies.

Encourage the dissemination of knowledge and best practices

- Create knowledge hubs or online platforms where stakeholders can access resources, research, case studies and best practices.
- Publish regular reports on the progress of initiatives, highlighting successful case studies and lessons learned.

Ensure adequate and coordinated funding for initiatives

- Develop joint funding programmes where the Government, industry and international donors pool resources to support key projects and initiatives.
- Promote the efficient use of resources by identifying and leveraging existing assets, infrastructure and expertise within the sector.

8.3.5 Promotion of the green transition of the engineering sector

Promote sustainability and environmental practices

Sustainability was a recurring theme in the survey, key informant interviews and workshop findings, with many SMEs recognizing the need to adopt environmentally friendly practices to remain competitive. Providing support for green technology adoption will help SMEs reduce their environmental impact and attract eco-conscious clients.

- **Sustainability standards:** Develop and enforce sustainability standards and provide support for SMEs to meet these standards. The workshop findings emphasized the importance of sustainability governance and community sustainable development (highlighted by groups 2 and 3). Developing sustainability standards and supporting SMEs in meeting these standards will ensure that firms across both sectors can remain competitive in a market increasingly focused on eco-friendly and sustainable solutions.
- **Green technology grants:** Offer grants and incentives for the adoption of green technologies and sustainable practices. This recommendation supports the adoption of green technologies, in line with the sustainability priorities identified in the survey, key informant interviews and workshop discussions.
- **Environmental training:** Provide training on environmental management and sustainability to ensure firms are aware of and comply with global standards.

A summary of the recommendations is presented in **Annex V**.

Conclusion

The engineering products and engineering services sectors are a crucial part of Jordan's economy, significantly contributing to GDP and exports. In 2021, the engineering products sector added 199 million dinar to GDP, accounting for 5.0 per cent of manufacturing GDP and 14.1 per cent of manufacturing exports. Additionally, this sector supports around 10,000 jobs. Similarly, the engineering services sector, which includes architectural and engineering services, contributes 8–10 per cent to GDP and employs 11,535 people.

Despite its economic importance, the sector faces several challenges. One major issue is workforce composition, with a noticeable gender imbalance, where women represent only 16 per cent of the workforce. Moreover, youth participation is lower compared to that of older men, indicating the need for a more inclusive work environment.

Recruitment remains a persistent challenge due to significant skills shortages. Around 48 per cent of firms find it difficult to hire qualified candidates, and retention issues are exacerbated by concerns over competitive salaries and career progression opportunities.

Workforce skills and training present notable challenges. A significant skills gap exists, with employees lacking the technical skills to operate advanced machinery and software. Comprehensive training programmes and continuous professional development are essential to ensure the workforce is equipped with the latest skills and knowledge.

Training and skills development disparities further compound these challenges. Larger firms tend to invest more in employee training compared to SMEs, which struggle with budget constraints. High training costs, outdated programmes, and logistical difficulties significantly hinder effective skill development across the sector.

Moreover, the sector faces distinct financial and regulatory constraints. Processors struggle with securing investment capital and managing payments due to regulatory hurdles. Therefore, improved investment access and regulatory reforms are essential for the sector's growth.

The need for enhanced local sourcing and improved enabling services continues to be a significant challenge. This encompasses the development of the local supplier base, effective management of supplier relationships, ongoing procurement operations, and the oversight of sourcing intermediaries.

Lastly, there is a significant gap in market information and data analytics capabilities. Many firms lack the tools and expertise to analyse market trends effectively. Investing in market research capabilities and data analytics is crucial for informed strategic decision-making and competitive advantage.

Despite some challenges, there are promising market opportunities for Jordanian companies, particularly in Gulf Cooperation Council countries such as the Kingdom of Saudi Arabia. Jordan's engineering products sector holds substantial growth potential driven by strategic market opportunities and technological advancements. Leading local firms leverage 3D printing, robotics and automation to enhance efficiency and quality. Collaborations with academic institutions and research centres further bolster innovation. Access to markets via free trade agreements such as the Greater Arab Free Trade Area agreement and the Jordan-European Union Association Agreement boosts export opportunities. High-potential export markets highlight strong international interest. In the engineering services sector, sustainability initiatives and large-scale projects in the Gulf Cooperation Council countries and Iraq offer significant market potential. Adherence

to international standards ensures quality and regulatory compliance. Incorporating advanced technologies strengthens service offerings and competitiveness.

In order to realize the opportunities of the engineering sector, it is essential to reduce the critical business capability gaps identified in Jordan's engineering products and services sectors. These capability gaps have significant implications for the industry's growth and competitiveness.

The engineering products sector faces challenges in fostering a culture of trust and dialogue within industrial relations, adhering to health and safety standards, and improving operational efficiency and product innovation. Additionally, there is a need for better supplier management and logistical planning, particularly in sourcing, developing the local supplier base and enhancing after-sales services. These gaps underline the importance of skills in communication, innovation, financial management and logistics to drive sectoral improvement.

Similarly, the engineering services sector struggles with quality assurance, regulatory compliance and sustainability practices, which are compounded by inefficiencies in cost management and the underdevelopment of local supplier networks. The sector also faces challenges in adopting modern information technology systems and technology, alongside maintaining occupational health and safety standards. Addressing these gaps will require targeted skill development in quality control, regulatory adherence, community sustainable development and occupational safety. By focusing on these areas, both sectors can enhance their operational effectiveness, align with international standards and ensure long-term sustainability and growth.

In both the engineering products and engineering services sectors, significant skills shortages were identified in critical roles such as maintenance engineers, product development engineers, data analysts, R&D engineers, and environmental health and safety managers. The misalignment between the skills provided by educational

institutions and industry needs, particularly in TVET colleges and universities, is a key factor contributing to these shortages. Systematic constraints, including inadequate funding, outdated curricula and poor governance, further exacerbate the issue, highlighting the urgent need for targeted interventions to address these skills gaps and ensure sustainable growth for the sectors.

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I. Methodological approach

Part 1: Desk review

The initial phase of the study involved a comprehensive desk review of existing literature and data sources to establish a foundational understanding of the targeted sector. This phase provided the essential context and baseline data necessary for the subsequent field research.

The desk review findings were utilized in the following sections of the study:

- Sector profile (for example, GDP, employment, exports and imports)
- Patterns and trends in trade
- Institutional framework (for example, legal framework and supporting functions)
- Market access overview

Part 2: Field research

The second part of the assignment included field research aimed at enriching and strengthening the insights collected from secondary research by delving into the specifics of the targeted sector. While secondary research provided a foundational understanding, the field research offered additional data to draw more reliable conclusions and create the value chain analysis for each sector. This was achieved through a combination of surveys, interviews, workshops and focus group discussions. This comprehensive methodology not only validated and enhanced the information obtained through desk research but also uncovered new dimensions, challenges and opportunities. By bridging the gap between secondary research and field research, the data collection process contributed significantly to a deeper and more detailed analysis of the sector, ensuring that the secondary research findings reflected the richness and complexity of the industry.

Field research findings were utilized in the following sections of the study:

- Value chains
- Sector employment and skills needs
- Drivers for future growth
- Market opportunities and challenges

Surveys conducted and sampling

Surveys were conducted to gather quantitative data from a broad cross-section of firms of different sizes (micro, small, medium-sized and large) within the targeted sector. A representative sample was identified using stratified sampling to ensure diverse representation across different sizes, locations and types of firms. The survey included structured questions covering key performance indicators, financial metrics, technology adoption and innovation activities. This method provided a large dataset that helped quantify trends and patterns within the sector.

The research involved firm-level data collection through structured interviews with key personnel, as well as discussions with ecosystem players, international experts and global value chain participants. A technical and policy foresight workshop engaged diverse stakeholders to develop sector-level skills governance arrangements and action plans. This approach aimed to enhance competitiveness, promote exports and equip workers with essential skills, ensuring a robust analysis of the sector's current landscape and future opportunities.

Sample size

- Quantitative survey: A total of 33 enterprises from both sectors participated in the quantitative survey.
- Qualitative survey: A total of 45 interviews were conducted, distributed as follows:
 - 12 enterprises
 - 23 ecosystem players
 - 10 informal workers

Representative quantitative sample

The quantitative sample comprised companies with the following distribution:

- 48 per cent were aggregators;
- 14 per cent were raw material suppliers;
- 17 per cent were both raw material suppliers and aggregators;
- 14 per cent were aggregators-processors;
- 4 per cent were manufacturers;
- 3 per cent were processors.

This distribution ensured a broad representation of the various roles within the engineering products and services sectors.

List of interviewees

Interviews were conducted with a wide range of stakeholders to gain qualitative insights:

- **Firm-level interviews:** Chief executive officers, managers and department heads from a representative sample of firms.
- **Ecosystem players and experts:** Representatives from employers' organizations, chambers of commerce, trade unions, industry support institutions and researchers.
- **International players and global experts:** Key figures from international value chains and experts with a global perspective on technology and investment.

The selection of interviewees was strategic to ensure that multiple perspectives were captured, enhancing the richness of the data collected.

Part 3: STED technical and policy foresight workshop

This workshop aimed to support the development of sector-level skills governance arrangements, share the cooperation activities in the sector and engage participants in the key stages of diagnostics and planning on the skills needs for the target sector. Workshop participants included business representatives, workers' and employers' organizations, key government ministries and agencies, and education and training providers.

To ensure a comprehensive and inclusive approach, the workshop employed a multifaceted method that:

- identified key stakeholders, ensuring representation from various sectors including business, workers' and employers' organizations, government ministries, agencies and education/training providers;
- facilitated interactive discussions, brainstorming sessions and group activities to encourage diverse perspectives and collaboration;
- captured insights and recommendations through documentation and feedback mechanisms during the workshop;

► **Table 19** Summary table of entities participating in the STED workshop

Entity type	Number	Percentage
Government	18	45%
Industry/employers' organization/ business membership organization	11	28%
Workers' organization	2	5%
TVET institution	7	18%
Other	2	5%
Total	40	100%

Source: Results of STED workshop held in July 2024.

- ensured gender and age inclusivity by actively involving women, men and youth representatives in the workshop sessions.

Each method used in the data collection phase contributed uniquely to the comprehensive understanding of the sector:

- **Surveys:** Provided quantifiable data on key metrics, allowing for statistical analysis and identification of patterns and trends.
- **Interviews:** Offered in-depth insights and qualitative data that helped understand the challenges, opportunities, and nuanced experiences of stakeholders.
- **Workshops and focus group discussions:** Facilitated interactive discussions and collaborative problem-solving, generating practical recommendations and fostering stakeholder engagement.

By combining these methods, the field research provided a holistic understanding of the targeted sector, encompassing both local and global perspectives. The methodology ensured a balance between quantitative data and qualitative insights, fostering inclusivity and collaboration among various stakeholders.

STED workshop findings were utilized in the following sections of the study:

- Envisioning the future
- Visions for inclusive and sustainable growth in the future
- Business capability gaps
- Skills implication of business capability gaps
- Skills supply and mismatch
- Systematic constraints in the skills supply
- Skills shortages
- Skills gaps

II. Perspectives of ecosystem players and international stakeholders in the engineering sector

Key informant interviews were conducted with ecosystem players, which refer to a diverse group of key stakeholders involved in the sector, including educational institutions, government bodies, research organizations, industry associations and economic forums. Key informant interviews were carried out with representatives from notable entities such as Philadelphia University, Hashemite University, the University of Jordan, the Applied Science Private University, and the Royal Scientific Society's National Energy Research Centre. Additionally, insights were gathered from governmental agencies such as the Ministry of Investment, the Ministry of Industry, Trade and Supply, and the Ministry of Labour, as well as industry associations including the Amman Chamber of Industry and the Irbid Chamber of Industry. Other important contributors included the Jordan Economic Forum, the Jordanian National Commission for Women, the Technical and Vocational Skills Development Commission, and the Economic and Social Council of Jordan.⁴ These entities collectively contribute to shaping the regulatory, financial and operational frameworks of the sector, making them critical players in the ecosystem.

According to the key informant interviews conducted with ecosystem players, the challenges identified can be broadly categorized into regulatory, financial, market-related and operational issues among both engineering products and engineering services companies.

- **Regulatory challenges** include complex and lengthy licensing procedures, bureaucratic hurdles and high taxes, which create significant barriers to entry and operational efficiency.
- **Financial constraints**, particularly access to financing, remain one of the most significant hurdles, with high production costs requiring substantial capital investment. However, obtaining financing is challenging due to a lack of flexible business environments and supportive financial institutions.
- **Market-related issues** include intense price competition, difficulty penetrating export markets due to regional obstacles and stringent export legislation, and challenges in keeping up with global innovation trends and technological advancements.
- **Operational and support challenges** include a lack of business incubators, weak linkages between companies, difficulty finding qualified workers, and inadequate support from both the Government and the private sector.

Furthermore, the key informant interviews conducted with a sample of international stakeholders, such as the German Agency for International Cooperation, highlighted the importance of fostering a culture of innovation and entrepreneurship, simplifying and streamlining government procedures, and adopting strategies to improve the organizational environment among both engineering products and engineering services companies. Encouraging innovation and entrepreneurship involves providing support for R&D, facilitating access to new technologies, and promoting creative problem-solving among entrepreneurs. Simplifying government procedures includes reducing bureaucratic red tape, expediting licensing and approval processes, and implementing transparent and consistent regulatory practices. Improving the organizational environment involves enhancing corporate governance, fostering collaboration between industry players, and creating supportive networks and ecosystems.

⁴ The Economic and Social Council of Jordan is an advisory body for the Jordanian Government on economic and social issues and policies. It serves to institutionalize the participation of various stakeholders to achieve sustainable social and economic development, ensure transparent and credible dialogue, and enhance partnerships between the public sector, the private sector and civil society organizations.

In conclusion, addressing these multifaceted challenges requires a coordinated effort from all stakeholders, including the Government, the private sector and international partners. By improving access to finance, streamlining regulatory processes, enhancing market awareness, investing in advanced technologies, and fostering a supportive organizational environment, Jordan's engineering sector can overcome these challenges.

III. Visions for inclusive and sustainable growth in the future

During the STED workshop, the following vision statements were presented and validated:

Engineering products sector

- We aspire to achieve the sustainable growth of the engineering products sector in line with national strategies (the Economic Modernisation Vision, the Investment Promotion Strategy 2023–2026, and the National Strategy for Human Resource Development 2016–2025)
- To this end, we aim to enhance our competitiveness in regional and international markets by:
 - improving quality and driving innovation by investing in advanced manufacturing technologies and rigorous quality control systems, and by fostering R&D initiatives;
 - expanding into neighbouring Middle Eastern countries and key international markets, taking into advantage of free trade agreements;
 - developing a high-skilled workforce through targeted training programmes;
 - implementing inclusive training programmes, fostering industry-academia partnerships, and promoting equitable opportunities, particularly for youth and women.

Engineering services sector

- We envisage that Jordan will become a leading exporter of high-quality engineering services to regional markets such as the Gulf Cooperation Council countries and Iraq, leveraging its strategic focus on sustainability, environmental regulations and large-scale construction and reconstruction projects to drive regional growth and development.
- We aim to increase international recognition of Jordanian engineering firms by adapting international best practices, setting new standards for quality and competitiveness in the regional market, and fostering a culture of continuous improvement and innovation.
- We aim to implement pioneering and creative solutions that support the country's Nationally Determined Contribution and promote a green economy.
- We aim to enhance skills development by promoting work-based learning to increase the number of workers with practical skills and knowledge. Our vision includes equipping workers with hands-on experience through effective industry-academia partnerships, advanced vocational training programmes, and educational environments aligned with actual work requirements.

During the STED workshop, some questions driven from the above-mentioned vision statements were asked to the participants and the scaling results were as follows:

► Table 20 Scaling game on visioning questions

Scaling game on visioning questions	Yes	Maybe	No
1. [Policy] We aspire to deliver a vision for the development of engineering products in the Economic Modernisation Vision (2023–2025) and the Investment and Promotion Strategy (2023–2026) add engineering services in the Strategy Plan of the Ministry of Environment (2023–2025).	50%	42%	8%
2. [Market] We aim to enhance the export-oriented growth of two targeted sectors and value added by increasing local sourcing of parts and materials.	69%	0%	31%
3. [Green transition] We aim to promote sustainable and responsible engineering production and services by adapting green technologies, reducing environmental impact and complying with stringent sustainability standards.	93%	0%	7%
4. [Standards] We aim to improve product and service quality and enhance compliance with international quality and environmental standards, in order to increase the international recognition and competitiveness of our products/services.	94%	0%	6%
5. [Human resources] We aim to improve work culture, business and human resource management practices so as to enhance productivity, sustainability, gender equality, youth inclusion and social inclusion.	67%	33%	0%
6. [Skills development] We envisage that increasing the number of highly skilled workers who are proficient in cutting-edge technologies (advanced manufacturing, robotics and digitalization) will contribute to enhancing value added, growth, competitiveness, and compliance with global standards in Jordan's engineering sector.	93%	7%	0%
7. [TVET] Through targeted training programmes and enhanced industry engagement in TVET, we aim to bridge the skills gap, empowering individuals with the expertise to drive innovation, enhance productivity and lead sustainable practices.	100%	0%	0%
8. [Higher education] We envisage improving higher education programmes by updating engineering study plans, integrating work-based learning and promoting training relevant to targeted sectors.	80%	20%	0%
9. [In-service training] We envisage increasing more structured on-job training based on formal and regular skills needs assessment.	100%	0%	0%

Source: Results of STED workshop held in July 2024.

Participants were asked to explain their votes. The key discussion points for some questions were as follows:

- Question 2 [Market]: One opinion highlighted the risk of raw material shortages, suggesting that local production and export might be essential to mitigate this issue.
- Question 3 [Green transition]:
 - One perspective was that a shift to greener industries should be preceded by efforts to alter consumer attitudes towards sustainability.
 - Another opinion was that Jordan, as a developing country, may face challenges in adopting green transitions due to limited capacities.
 - One participant argued that addressing climate change through green practices is increasingly urgent, indicating that the transition to sustainable practices is necessary regardless of consumer attitudes.
- Question 8 [Higher education]: It was suggested that practical training centres might be more beneficial than relying solely on theoretical university training, and that emphasizing hands-on experience could better prepare students for real-world applications.
- Question 9 [In-service training]: It was agreed that, while there is a demand for structured on-the-job training, there is currently a lack of effective implementation, follow-up, evaluation and correction. Quality on-the-job training remains limited in Jordan.

► **Table 21** List of key occupations in the engineering products sector

Key function	Occupation	ISCO Code
Processing	1. Industrial engineers	2141
	2. Product development engineers	3115
	3. Skilled operators and assemblers	-
Installation and maintenance	4. Maintenance engineers	2151
Quality assurance and control	5. Quality control inspectors	3119
Logistics and supply chain	6. Supply chain managers	1324
	7. Procurement managers	1324
	8. Supply chain analysts	2422
	9. Warehouse operatives	4321
Environment and safety	10. Sustainability coordinators	2133

Source: Results of STED workshop held in July 2024

IV. Business capability gaps

The STED workshops identified several key business capability gaps in the engineering products sector in Jordan, each with specific implications for the skills required to address these challenges effectively.

► **Table 22** Skills implications of business capability gaps in the engineering products sector

Key business capability gaps	Skills implications	Main occupations affected
Development of trusting and dialogue-based industrial relations culture	Value proposition, innovation and communication skills	• Procurement managers • Supply chain managers
Health and safety standards	ISO 45001, report writing and planning	Sustainability coordinators
Efficiency/costs/working capital requirements	Lean manufacturing, just-in-time production and costing	Industrial engineers
Product improvement/product innovation	R&D skills and business skills	Product development engineers
Sourcing, development of local supplier base, management of relationships with suppliers, ongoing purchasing operations, and management of source intermediaries	Market integration, sourcing and enterprise resource planning skills	• Procurement managers • Industrial engineers
In-house logistics and after-sales services	Customer relationship management skills, Communication skills, enterprise resource planning skills, material handling	• Maintenance engineers • Supply chain managers • Warehouse operators

Source: Results of STED workshop held in July 2024.

► **Table 23** List of key occupations in the engineering services sector

Key function	Occupation	Group	ISCO Code
Design and development	1. R&D engineers	2	2149
	2. HVAC design engineers (and design engineers in general)	3	2141
Environmental compliance and sustainability	3. Sustainability coordinators	2, 3	2133
Environmental health and safety	4. Environmental health and safety managers	2, 3	2263
Logistics and supply chain	5. Supply chain managers	2, 3	1324
Research and analysis	6. Data analysts	2, 3	2421
	7. Laboratory technicians	3	3111
Others	8. Application programmers (information technology, programming and coding)	3	2514
	9. Artificial intelligence engineers and designers (artificial intelligence design)	-	2511

Source: Results of STED workshop held in July 2024.

► **Table 24** Skills implications of business capability gaps in the engineering services sector

Key business capability gaps	Skills implications	Main occupations affected
Quality assurance and quality control	• Ability to determine specific, measurable, achievable, relevant and time-bound key performance indicators • Knowledge of ISO certificates	• Supply chain managers and logistics workers • Procurement specialists and research scientists • Data analysts, project managers, construction managers, and environmental health and safety managers
Implementation of regulatory requirements	Understanding of current regulations and flexibility	• Environmental health and safety managers • Project managers, R&D engineers, product development engineers and supply chain managers • Logistics workers
Community sustainable development	Planning skills, high level of psycho-social support skills, knowledge of implementation of SDGs, monitoring and evaluation skills	• R&D engineers • Project managers • Environmental compliance officers • Supply chain managers
Efficiency/costs/working capital requirements	Ability to use engineering programmes and applications	HVAC design engineers (design engineer in general)
Developing local supplier base	Ability to access local market needs and conduct relevant studies, and strong communication and customers care skills	Supply chain managers
Occupational health and safety standards	Understanding of handling materials and tools based on safety standards	Laboratory technicians

Source: Results of STED workshop held in July 2024.

Table 22 outlines the critical gaps and the associated skill needs, as well as the main occupations that are most affected.

V. Summary of recommendations developed in the STED Workshop

Engineering products sector

In the engineering products sector, several key proposals emerged in order to address occupation-specific skills gaps. The first proposal was the development of a training programme for warehouse operators. This initiative would aim to address the gap in scientific knowledge among warehouse operators, who currently rely heavily on memory and experience. Formal training is expected to enhance their efficiency and accuracy in daily operations. The training would target industry warehouse operators, particularly within SMEs, and would be organized and supervised by the JCI.

The second proposal was to create a tax incentive programme to support R&D and innovation. This initiative would seek to boost the competitiveness of local products in international markets by offering tax incentives to companies engaged in R&D. The programme would be led by the JCI, relevant ministries, and R&D councils. However, challenges would include defining clear indicators and mechanisms for monitoring whether companies receive and effectively utilize the incentives.

The third proposal was to enhance the core technical skills of industrial engineers through a training programme. This 6–12-month programme would involve mentorship from senior engineers, aiming to transfer practical and technical knowledge to junior engineers. The beneficiaries would include industry business owners and junior industrial engineers. The Industry Chambers and the JEA would manage the programme, which would involve partnerships with both large firms and SMEs.

Engineering services sector

In the engineering services sector, proposals were also made to address specific skills gaps. The first proposal was to develop a training course for data analysts. The course would aim to address the current shortage of data analysts by incorporating data analysis into educational curricula and offering additional capacity-building programmes. Beneficiaries would include governmental organizations, the private sector and non-governmental organizations, with the Ministry of Digital Economy and Entrepreneurship overseeing implementation.

The second proposal was to enhance supply chain management skills through training courses and knowledge exchange with international companies. This proposal targets the shortage of skilled supply chain managers and includes collaboration with international firms to improve management practices. The Ministry of Labour, Ministry of Industry, Trade and Supply and Ministry of Planning and International Cooperation would lead this initiative, benefiting training centres, companies and supply chain employees.

The third proposal was to establish add-on training programmes for R&D engineers. This initiative would aim to address the lack of certified R&D engineers by providing additional training and scholarships in advanced skills such as machine learning and artificial intelligence. The programme would also seek to motivate youth to pursue R&D careers. Beneficiaries would include the private and governmental sectors, graduates and universities, with leadership by the Ministry of Higher Education and the Ministry of Planning and International Cooperation.

Overall, the workshop highlighted the need for practical implementation strategies and robust monitoring and evaluation mechanisms to ensure the effectiveness of these proposals.

In conclusion, addressing these multifaceted challenges requires a coordinated approach involving the Government, industry, and educational institutions. By tackling financial constraints, streamlining regulatory processes, investing in infrastructure and improving recruitment and training practices, Jordan can enhance its engineering sector's global competitiveness and support sustainable economic growth. Simultaneously, leveraging technological advancements, strategic collaborations and market opportunities will drive the sector's growth and resilience.





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