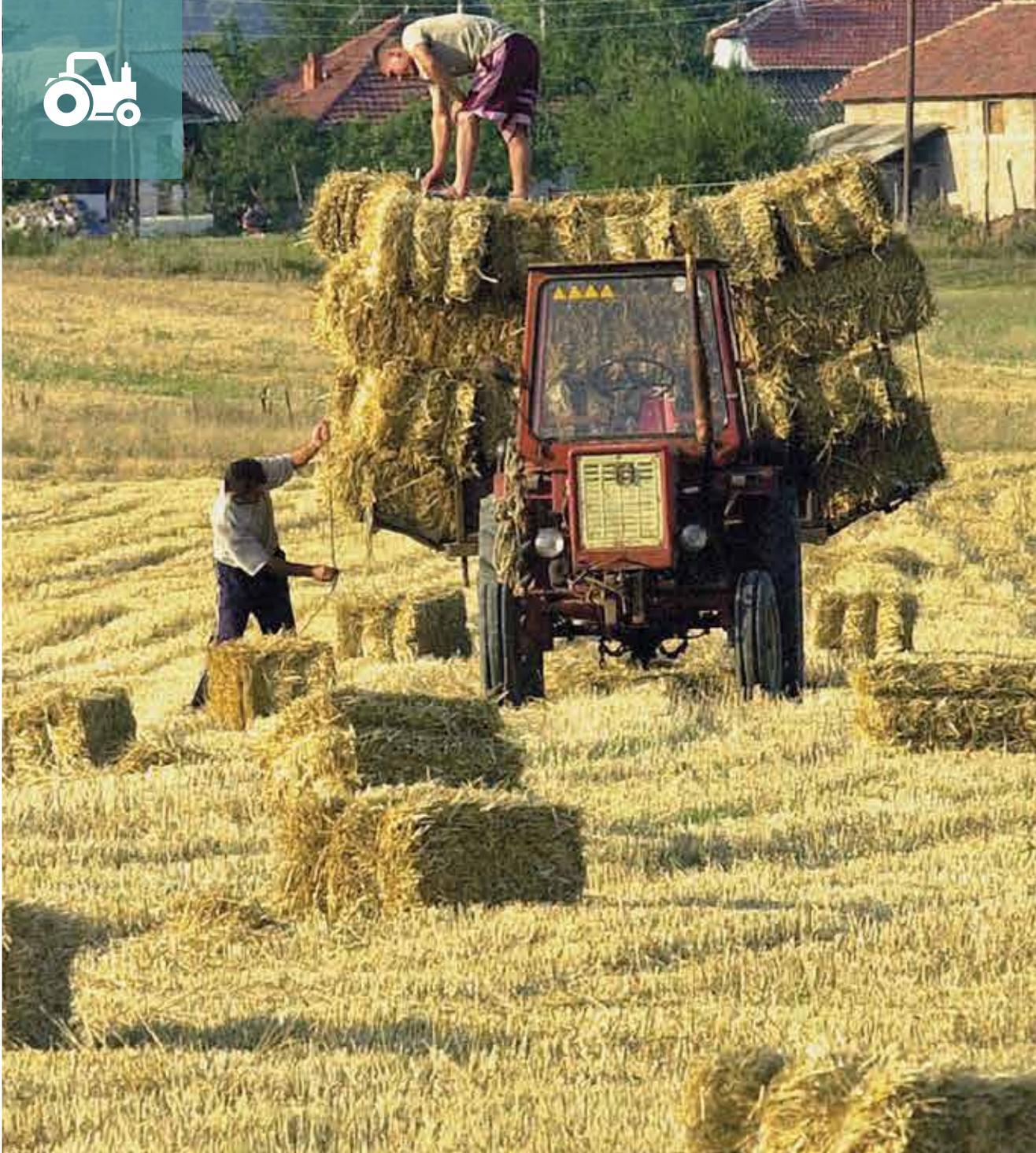
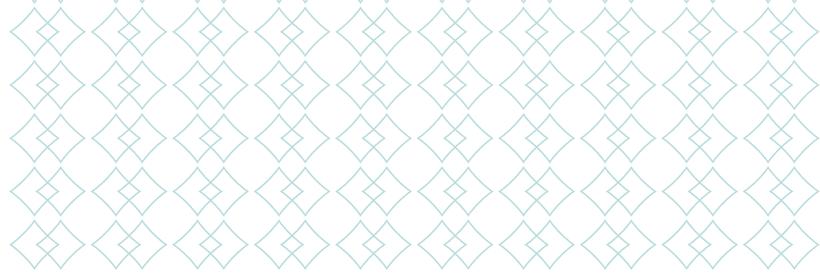


4

Machinery





Each year during plowing season, Leela Rajput used to hire 15 laborers to work from dawn until dusk every week preparing his 10-hectare plot in the north-western Indian state of Uttar Pradesh. This year, he will use a tractor instead. With the machine, he expects to finish the job in a single day. Indian agriculture is belatedly engaged in a mechanical revolution, boosting productivity in a sector that has long relied on cheap labor to tend crops in the world's second most populous country. Job opportunities in cities have drained the pool of workers in villages. "I just can't find enough people to do the hard work in the fields anymore," says Mr. Rajput. He adds that the tractor helps bring more women into the workforce by making the work less physically demanding.¹

Farm machines are indispensable to modern agriculture. Some of the most significant increases in farming productivity have been achieved as a direct result of agricultural machines.² Agricultural mechanization offers the ability to increase agricultural productivity by bringing more land under cultivation and by improving the timeliness of operations, thereby enabling markets for rural economic growth and improving rural livelihoods.³ By enhancing the efficient utilization of inputs such as seeds, fertilizers, plant protection chemicals and irrigation water, and expanding cultivated areas, agricultural mechanization can greatly enhance farming profitability and reduce human drudgery. This change can make farming a more viable and attractive commercial enterprise, particularly for youth, and promote rural employment. Furthermore, the benefits of agricultural machinery become particularly important as the demand for food, fiber and fuel continues to rise against a backdrop of expanding urbanization and increased constraints on land and water resources.⁴

Despite its benefits, mechanization levels still vary widely across the globe. In the countries studied for *EBA 2017*, high mechanization levels are observed in European countries, with penetration rates of 1,300 tractors per 100 square kilometers of arable land, as in the case of Poland.⁵ By contrast, low mechanization levels persist in many developing countries, particularly in Sub-Saharan Africa, with penetration rates as low as 2.24 tractors per 100 square kilometers of arable land, as in the case of Mali. In many regions, mechanization's low contribution to agricultural development is partly due to the fragmented policy approaches taken by governments on mechanization issues.⁶ Despite its high cost and high profile, agricultural machinery is an input like any other and the policies, laws and regulations impacting the industry affect the way in which mechanization inputs are made available on the market, including their accessibility, commercial viability and safety. For example, most countries today leave the importation and sale of tractors to the private sector. However, the public sector continues to be involved in matters related to licensing, inspection and testing, and other areas of regulation regarded as being in the public interest.



What do the machinery indicators measure?

Agricultural tractors are used as a proxy to measure laws and regulations that may restrict tractor imports and operations, as well as the quality requirements applicable to imported tractors (table 4.1). Agricultural tractors were chosen for their relevance and comparability, given that tractors are imported and used around the globe, unlike other forms of machinery that are region or crop specific. The machinery indicators are organized as follows:

Tractor imports: This indicator measures aspects related to importing agricultural tractors, including the ability of private sector companies to import and sell tractors, and the procedures for registering as a tractor importer and for obtaining an import permit. Few developing countries manufacture agricultural equipment and machinery domestically. As a result, demand must be met through imports, typically handled by the private sector though sometimes managed through government imports. Even where the private sector is involved, however, tractor importation procedures can be cumbersome and time consuming for businesses, due to unnecessary or inefficient bureaucracy. This inefficiency negatively impacts the process and increases transaction costs and delivery times. An efficient and inexpensive process can greatly ease supply constraints for tractor importers and improve tractor distribution in a country.

Tractor operations: This indicator measures the legal and practical dimensions of registering agricultural tractors and completing inspections of in-use tractors, as well as the requirement that tractor dealers provide after-market tractor service and parts. Registering agricultural tractors not only establishes ownership rights over the purchased tractor but it also facilitates

the enforcement of road, safety and tax regulations. Furthermore, a substantial proportion of the tractor fleet in many countries is not safe for operation due to poor maintenance and a lack of repairs.⁷ Therefore, most countries require that tractors be inspected at regular intervals to identify faults and conduct repairs, which can, in turn, improve tractor performance. Agricultural tractors can have a life span of 5 to 30 years, but they can be kept operational only through regular servicing.⁸ Therefore, it is essential that farmers have access to tractor service and maintenance, and spare parts. A regulatory framework that promotes efficiency and reduces transaction costs for tractor registration and roadworthiness checks, while at the same time ensuring control and safety, can enhance the uptake of machinery and protect tractor users.

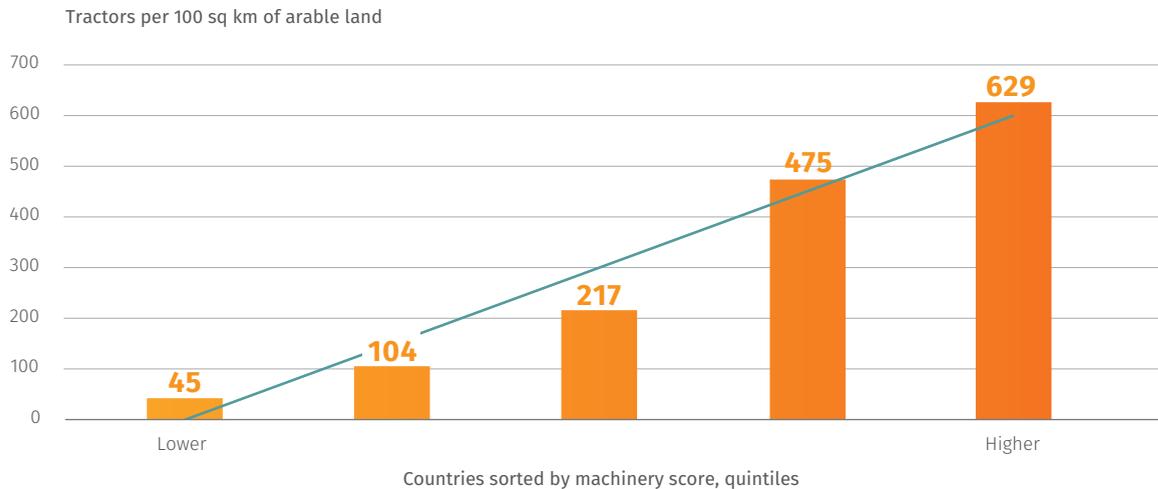
Tractor testing and standards: This indicator measures the legal and practical dimensions of tractor testing, the prevailing tractor type approval⁹ process in a country (including the associated procedures, time and costs) as well as tractor performance and operator safety standards. Standardization and tractor testing systems alone cannot boost mechanization growth. However, appropriate testing and streamlined type approval procedures for agricultural tractors—undertaken in conformity with established national or international standards—can increase the safety and technical reliability of tractors, reduce the environmental and social cost inflicted by substandard tractors, and increase farmers’ access to safe, reliable and efficient machinery.¹⁰ While the absence of testing and standards may help encourage growth in agricultural mechanization in the short-term, it risks problems emerging in the future.¹¹ Therefore, a thorough testing and evaluation of a tractor’s performance, its quality, durability and safety, should be required.

Table 4.1 | What do the machinery indicators measure?

TRACTOR IMPORTS	<ul style="list-style-type: none"> • The private sector’s ability to import and sell tractors • Importer registration and renewal requirements, including registration validity • Import permit requirements, including permit type, cost and validity
TRACTOR OPERATIONS	<ul style="list-style-type: none"> • Tractor registration requirements • Roadworthiness inspection of in-use tractors, including inspection cost • Provision of after-market service and parts • Time and cost of tractor registration
TRACTOR TESTING AND STANDARDS	<ul style="list-style-type: none"> • National and international standards applied in the country • Tractor type approval requirements, including testing, validity and international recognition • Requirement of protective structures and seatbelts • Time and cost of type approval

Source: EBA database.

Figure 4.1 | The number of tractors per 100 square kilometers of arable land is highest in countries that score well in EBA machinery legal indicators



Sources: FAOSTAT, EBA database.

Note: The correlation is 0.52 between the machinery score and the number of tractors per 100 square kilometers of arable land from the FAOSTAT dataset. The correlation is significant at a 5% level after controlling for income per capita.

How do countries perform on the machinery indicators?

The countries that score high on the machinery indicators tend to have higher tractor penetration rates (figure 4.1). Certainly, there are several factors—such as specific mechanization policies and market realities—that affect the agricultural machinery sector and contribute to the adoption of tractors for agricultural production. However, the enabling regulatory environment for agricultural machinery and the efficiency with which governments are implementing laws and regulations are important precursors for a well-functioning tractor market.

Countries with the highest score on the machinery topic, such as Poland, Romania, Serbia and Turkey, share many common features (table 4.2). These countries facilitate streamlined import procedures, making it easy for tractor importers to introduce their products to the market, while at the same time promoting adequate control and inspections to ensure that tractors meet quality, durability and safety standards. The countries with the lowest scores, such as Liberia, Mali and Myanmar, each demonstrate room to adopt many of the identified good practices. For example, importing tractors is cumbersome in these countries and standards with regards to quality, performance and safety are not established or followed. Regulations on tractor registration, type approval, roadworthiness inspection and tractor maintenance provision are weak or absent in these countries.

The quality of regulations and practices in the tractor operations and the tractor testing and standards indicators vary greatly across countries. The three countries within the Middle East and North Africa region (Egypt, Jordan and Morocco) and most OECD high-income countries covered have robust regulations on tractor operation that require tractors to be registered and inspected for roadworthiness. Most of these countries also make the provision of after-market parts and services a statutory requirement, ensuring road safety and security to customers. OECD high-income countries and countries in the Europe and Central Asia region score highest on tractor testing and standards,

Table 4.2 | Where are machinery regulations strongest and most efficient?

STRONGEST AND MOST EFFICIENT		WEAKEST AND LEAST EFFICIENT	
1	POLAND	58	PERU
2	SERBIA	59	LAO PDR
3	ROMANIA	60	LIBERIA
4	TURKEY	61	MALI
5	GREECE	62	MYANMAR

Source: EBA database.



as most of them require tractors to be tested and type approved, while at the same time mutually recognizing the certifications issued by other countries. By contrast, countries in the Latin America and Caribbean region score low in this indicator because regulations on tractor testing, as well as tractor performance and safety standards, are not established.

Although the scores on tractor imports do not vary as much across countries as for tractor operation and tractor testing and standards, differences do exist. The 8 OECD high-income countries¹² and the 11 countries in Europe and Central Asia¹³ region have implemented all the good practices identified under the tractor imports indicator. For example, these countries do not require importers to register in addition to the general business license, and import permits are not required in these regions. By comparison, countries in Middle East and North Africa and Sub-Saharan Africa regions have lower tractor imports indicator scores.

The data show that countries that score higher on tractor imports and operations also tend to have stronger laws on tractor testing and standards. Scores also indicate that regulatory efficiency on the one hand—as defined by the time and cost involved in complying with target regulations—and tractor quality control regulations on the other, tend to be complements rather than substitutes. Countries with a strong legal framework also often have less burdensome procedures in terms of time and cost associated with tractor registration and tractor type approval (figure 4.2).

What are the regulatory good practices?

Box 4.1 highlights regulatory good practices and some countries that implement these practices.

Safeguard availability and timely delivery of agricultural tractors through streamlined import procedures

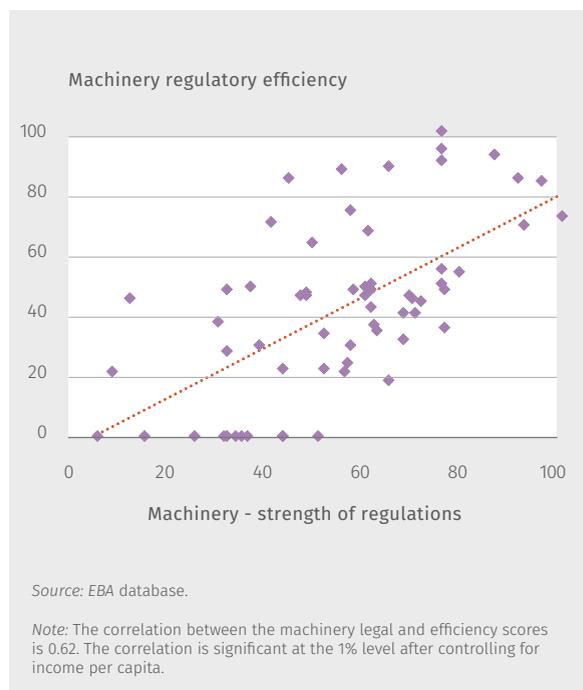
Complex import formalities impede the flow of international trade and increase the time and cost to import.¹⁴ Nevertheless, many countries continue to require permits as a prior condition for the importation of tractors. Where permits do exist, the application process should be as efficient and cost-effective as possible, the validity should be unlimited and there should be no restrictions in terms of quantity of tractors or number of shipments.

Among the 62 countries studied, 17 require importers to obtain permits to import tractors. Sometimes, import permits are intended to provide assurance on the shipment quality¹⁵ or to limit the quantity of imports to protect local manufacturing. None of the OECD high-income and Europe and Central Asian countries—many of them manufacturers of tractors—require import

permits. Among the 17 countries where import permits are required, only Bangladesh, Cameroon, Côte d'Ivoire, Ethiopia and the Philippines allow permits with no restrictions in terms of quantity or number of shipments, and the permits have a validity of 12 months. By comparison, Lao PDR and Myanmar require that importers apply for a permit for *each* tractor shipment and the permit validity is only three months, making it comparatively burdensome for tractor importers to introduce their products to the market.

The data also shows that many countries—almost all of them low-income or lower-middle-income countries—require private companies to register as tractor importers *in addition* to the general business license. Countries may have introduced this requirement to monitor trade flows and the quality of imported goods, but the process should be efficient and affordable to limit its impact on trade flows. In half of the countries where this procedure is required, the registration is indefinite and does not have to be repeated. But in 14 countries, the registration has to be renewed after a number of years or after half a year, as in the case of Colombia. While the registration renewal is automatic in four countries, tractor importers in six Sub-Saharan countries, and in Bangladesh, Colombia, Myanmar and Sri Lanka have to undergo the entire process of registration renewal each time.

Figure 4.2 | Countries with strong regulatory frameworks implement their laws more efficiently



Box 4.1 | What are the regulatory good practices for machinery?

	REGULATORY GOOD PRACTICES FOR MACHINERY	SOME COUNTRIES WHICH IMPLEMENT THE PRACTICE
TRACTOR IMPORTS	Businesses are not required to register as importers, beyond general business registration requirements. In countries where importer registration is required, the registration validity is indefinite or registration renewal is automatic.	DENMARK, KOREA, REP., NIGERIA
	Importers do not have to apply for an import permit each time they want to import. In countries where the import permit is required, it is a time-efficient, low-cost process. The permit is a blanket document (without any restrictions in terms of volume or number of shipments) with unlimited validity.	COLOMBIA, ITALY, TANZANIA
TRACTOR OPERATIONS	Tractor registration is required for on-the-road-use only, and the process is affordable and efficient	BOSNIA AND HERZEGOVINA, MALAWI, POLAND
	Regular inspections of in-use tractors are mandatory, affordable and undertaken in reasonable intervals (frequency of every two years).	TURKEY, ZIMBABWE
	Tractor dealers must provide after-market service and parts.	JORDAN, MALAYSIA, ROMANIA
TRACTOR TESTING AND STANDARDS	Countries have established national tractor performance and operator safety standards or follow established international standards.	SERBIA, UKRAINE
	Countries require tractors to be type approved before entering their market to ensure that the tractor conforms to the legal standards (such as safety, material, dimensional and performance standards) where it is being sold. Tractor type approvals and test reports issued by an authority in another country are recognized. If tractor tests are undertaken in a local testing center, the process is efficient and affordable.	INDIA, MOROCCO
	The tractor type approval is not time limited, provided that the specifications of the tractor remain unchanged.	NIGERIA, RUSSIAN FEDERATION

Source: EBA database.

Facilitate tractor durability by requiring roadworthiness inspections and tractor after-market service and parts

Most countries require vehicles to be maintained in safe, roadworthy condition for them to be used on their roads. Given that agricultural tractors are increasingly used to replace trucks in local transport activities and for commercial road haulage purposes, tractors in many countries are subject to roadworthiness inspections at regular intervals. The tests are conducted at an authorized test center and typically include testing of the brake and steering systems, vision features, noise pollution and other features. Of the 62 countries studied, about half make regular

tractor roadworthiness testing mandatory. The data show that none of the countries in the Latin America and Caribbean region require inspections, with the exception of Chile and Haiti, while all four countries do in South Asia (Bangladesh, India, Nepal and Sri Lanka). European Union countries still have different requirements with regards to roadworthiness inspections of tractors. As of May 2018, however, the European Union will be harmonizing the minimum requirements for mandatory periodic roadworthiness tests for tractors with a maximum design speed exceeding 40km/h used for haulage on public roads.

Among those countries that require roadworthiness inspections, the period between required tests varies



Tractor, Aurangabad, India. Photo: Simone D. McCourtie / World Bank.

greatly. For example, in Burkina Faso, Malaysia and Uganda, the test is required every half-year. By contrast, in India the test is done only every five years. Experts suggest, however, that inspections should occur every two years.¹⁶ Only five countries—Poland, Romania, Spain, Turkey and Zimbabwe—take this approach. The cost of inspections also varies across countries, ranging from 0.2% income per capita in OECD high-income countries, to 6.5% income per capita in Sub-Saharan African countries.

Countries that mandate roadworthiness inspections should logically also ensure that farmers have access to appropriate repair services and spare parts. All too often, tractor operators do not have any support if a machine breakdown occurs, and tractor “graveyards” can still be found in many countries.¹⁷ Tractor dealers are not legally required to provide tractor maintenance and repair in the majority of countries studied for *EBA 2017*, with the exception of OECD high-income countries or those located in the Middle East and North Africa region.

Guarantee high-quality tractors by requiring type approval and testing of tractors in conformity with established standards

Agricultural tractors are imported from various countries. Although tractors are designed to satisfy a range of conditions, a machine produced in one country may or may not suit another country because of the prevailing edaphoclimatic conditions. The tractor design

and construction alone are not sufficient to judge and select a machine designed for a certain operation.¹⁸ As such, a thorough testing and evaluation should be required of the tractor performance, quality, durability and safety.

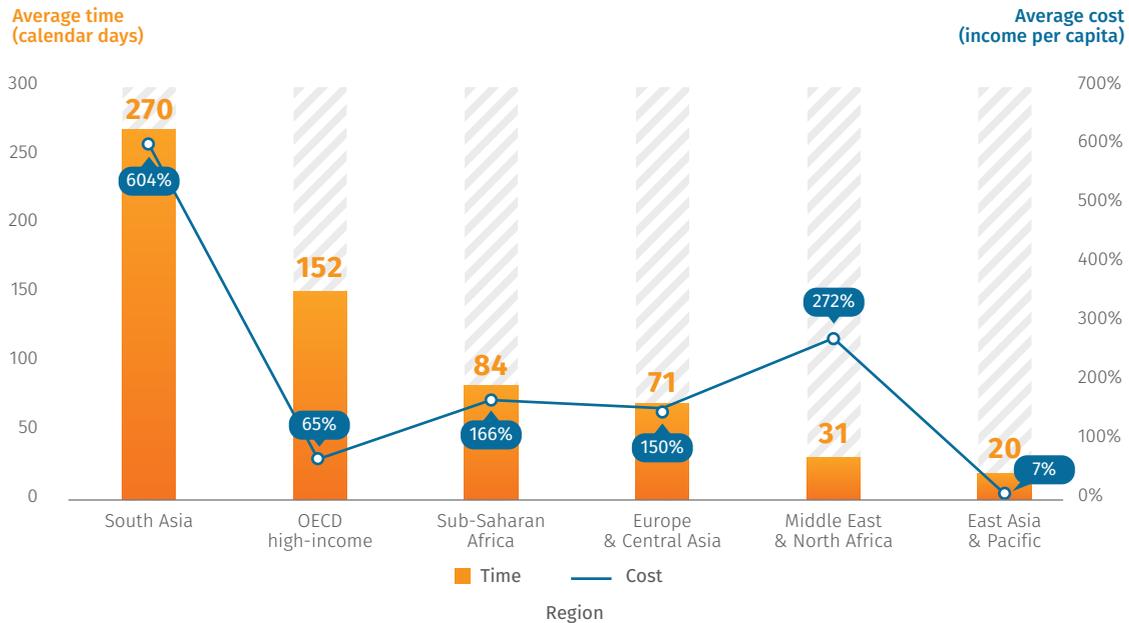
Tractor tests are typically undertaken in conformity with established national or international standards.¹⁹ Tractor performance and tractor operator safety standards ensure that only high-quality machines enter a country’s supply chain and they provide unbiased information to manufacturers and consumers of tractors. Among the 62 countries studied, it is mostly countries in the Europe and Central Asia region and OECD high-income countries that have established national performance and safety standards or that enforce international tractor standards.

Tractor type approval is mandatory in about half the sample countries. All OECD high-income countries (with the exception of Chile) and European and Central Asian countries (with the exception of Georgia) have this requirement, along with India, Morocco, the Philippines, Vietnam and 10 countries in Sub-Saharan Africa. It should be noted that while the type approval is legally mandated in these countries, there appears to have been no such practice in Armenia, Kyrgyz Republic and Tajikistan.

The procedures involved in tractor type approval vary across countries, and the associated time and cost are consistently higher in countries where multiple



Figure 4.3 | Time and costs for tractor type approval vary across regions



Source: EBA database.

Note: Latin America and Caribbean countries are excluded because tractor type approval is not mandatory in the countries studied in this region.

procedures are required (figure 4.3). While it is important that governments implement regulations in a time- and cost-efficient manner, a minimum number of steps should be involved to thoroughly test and evaluate a tractor and its performance. Tests should include laboratory testing and the issuance and publication of a test report. Many countries also test the tractor in the field, a procedure that is practiced in all OECD high-income countries (with the exception of Chile, where type approval is not required), as well as in Cameroon, India, Kazakhstan, Malawi, Nigeria, the Philippines, Romania, Russian Federation, Serbia, Sudan, Turkey and Ukraine.

Testing of agricultural tractors ensures the quality of tractors and their suitability for country conditions. Nonetheless, some of the main challenges traders face are costly and lengthy testing or certification of tractors, often duplicated across countries. Valuable business time and money could be saved if a tractor could be tested once and the results accepted in other markets for the tractor to be type approved.²⁰ The mutual recognition of conformity assessment results is strongly encouraged by the World Trade Organization (WTO) Agreement on Technical Barriers to Trade and is already operational in a number of existing networks in Europe and Asia and Pacific with regards to machinery testing.²¹ Such a model could be applied in Africa.

The 22 countries in which tractor type approval is required—most of them OECD high-income countries and countries in Europe and Central Asia, but also in

Cameroon, Côte d'Ivoire, Ethiopia, Morocco, Uganda and Zimbabwe—recognize type approval certifications issued in other countries. In the European Union, a tractor that is tested by a designated testing facility and type approved by an authority in a member country is automatically recognized and accepted in other member countries without the need for further testing. The approval has unlimited validity and renewed testing is not required, provided that the specifications of the tractors are the same.

As outlined above, multiple testing or certification of agricultural tractors represents a burdensome endeavor for companies in many countries. In Kazakhstan, Kyrgyz Republic, the Philippines, Russian Federation and Ukraine, the tractor type approval process has to be repeated after five years and in India after three years.

Conclusion

An agricultural machinery procedural framework that balances control and efficiency requirements can help facilitate and ease the availability of tractors for agricultural production. Countries such as Poland, Serbia and Romania demonstrate that regulatory efficiency on the one hand—as defined by the time and cost involved in complying with target regulations—and tractor quality control regulations on the other, tend to be complementary and are important precursors for a well-functioning tractor market.





NOTES

- 1 Mukherji 2013.
- 2 Reid 2011.
- 3 Sims and Kienzle 2006.
- 4 CEMA-European Agricultural Machinery 2014.
- 5 Food and Agriculture Data (FAOSTAT). FAO, Rome, <http://faostat.fao.org/>.
- 6 FAO and UNIDO 2008.
- 7 Houmy et al. 2013.
- 8 Clarke 2000.
- 9 Type approval (or “homologation”) is the official recognition given by a national authority or agency that certifies that the tractor conforms to the prevailing regulatory, technical and safety requirements in the country. Before the tractor can be sold on the market and before reaching the farmer, the manufacturer (or an agency on behalf of the manufacturer) must complete its type approval and be certified by third-party verification that its design, construction and performance respect the country’s regulations and standards.
- 10 UNESCAP/CSAM 2015.
- 11 Animaw et al. 2016.
- 12 The eight OECD high-income countries included in this year’s report are Chile, Denmark, Greece, Italy, Korea, the Netherlands, Poland and Spain.
- 13 The 11 countries in the Europe and Central Asia region included in this year’s report are as follows: Armenia, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyz Republic, Romania, Russian Federation, Serbia, Tajikistan, Turkey and Ukraine.
- 14 WTO Agreement on Import Licensing Procedures 1995.
- 15 UNCTAD 2012.
- 16 Council of the European Union 2014.
- 17 Houmy et al. 2013.
- 18 Tilakaratna 2005.
- 19 OECD 2012.
- 20 WTO 2016.
- 21 (1) The OECD Tractor Codes are a popular example of a standardization, testing and certification system under the umbrella of an intergovernmental organization; (2) the European Network for Testing of Agricultural Machines (ENTAM) is an agreement between different countries aimed at implementing standardized performance, safety and environmental tests of agricultural machinery and tools; and, (3) the Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM), launched in 2013, aims at promoting “harmonization of testing codes and standards of agricultural machinery applied in the region that address quality, performance, occupational safety and environmental sustainability of agricultural machinery” (UN-CSAM 2016).

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