



CEMA



Towards a competitive industrial production for Europe

Constructing our future, advancing agriculture



Agricultural Development and Mechanization in 2013

A Comparative Survey at a Global Level

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Outline

1. Major challenges for agriculture
2. Agricultural mechanization survey: Data sources and their limitations
3. Overview of agricultural mechanization in different regions of the world
4. Future trends and evolution of agricultural mechanization: Survey results:
 - Impact factors/drivers
 - Status and projection of agricultural mech. in surveyed regions
 - Cross regional comparison
5. Conclusions

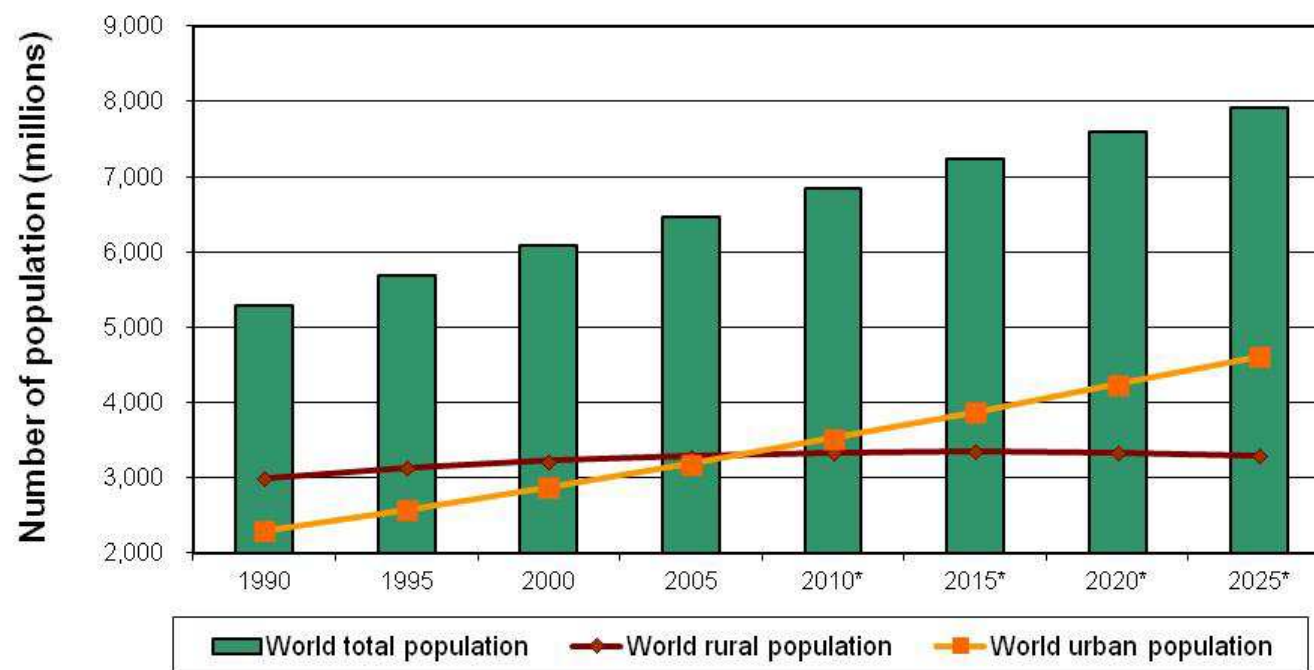


1. Major challenges for agriculture



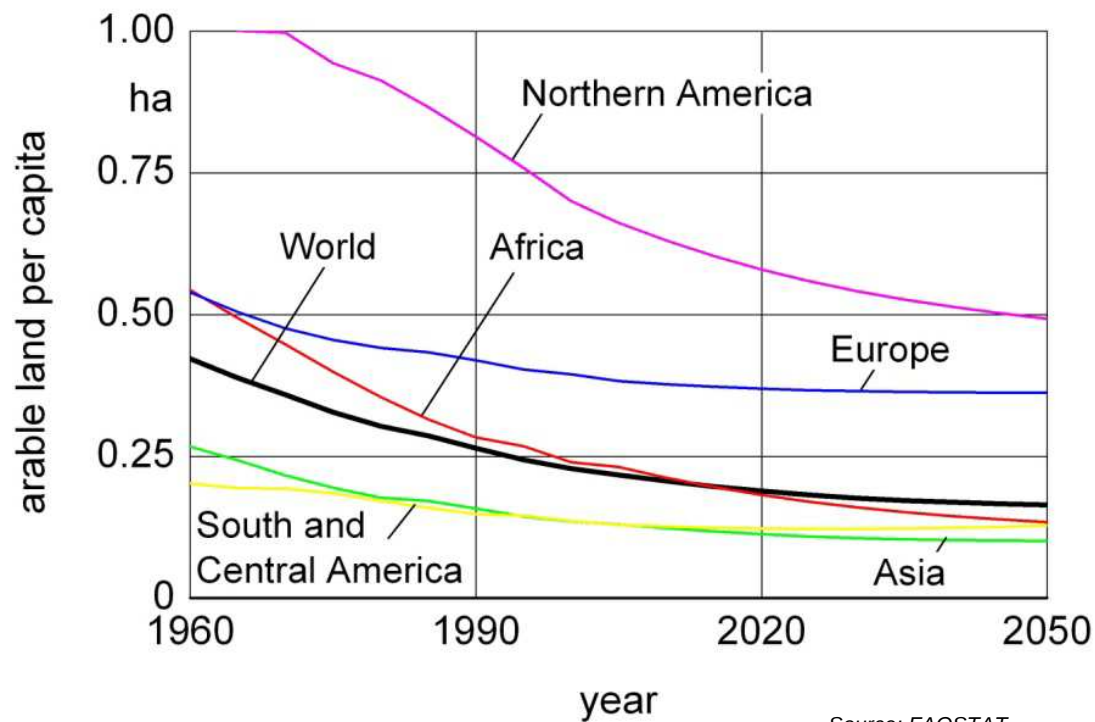
1. Major challenges for agriculture - World population

Increasing food demand and change in diets
due to economic growth & urbanization



Source: FAOSTAT

1. Major challenges for agriculture - Arable land development

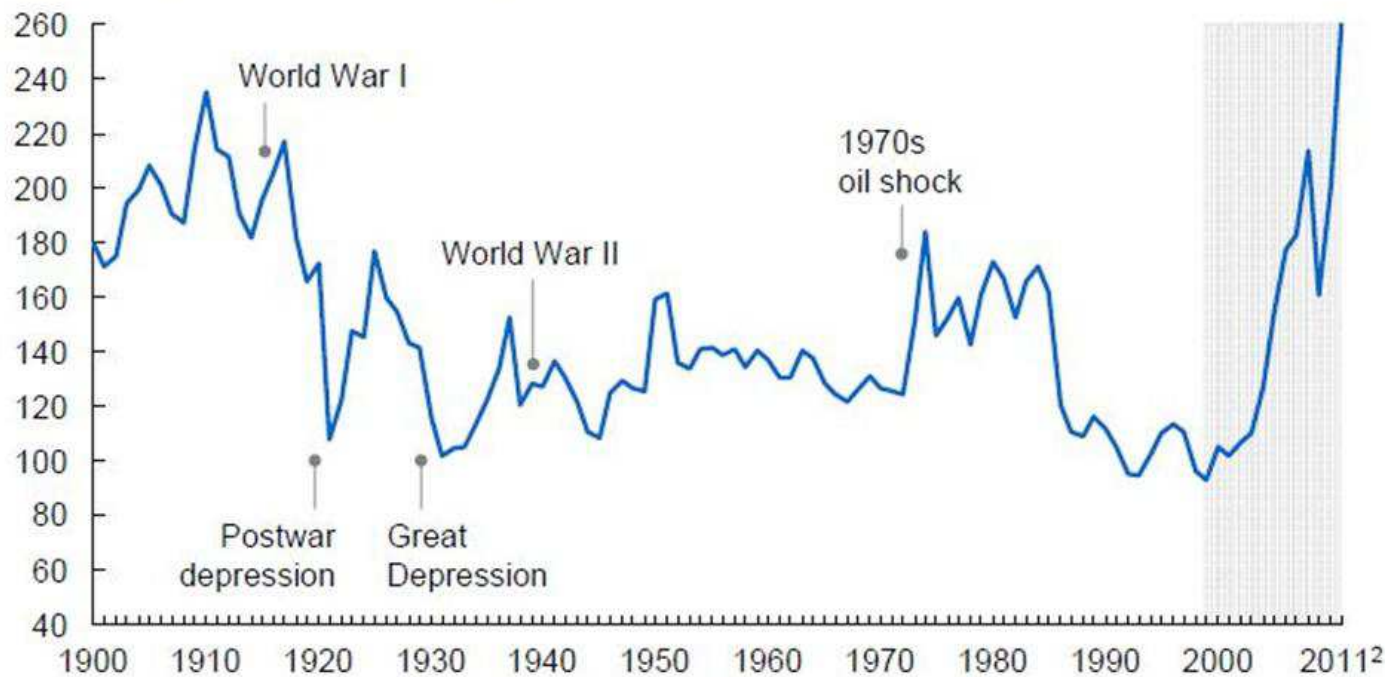


From 1950 to 2005 the land per capita has decreased approximately by **50 %**

Source: FAOSTAT

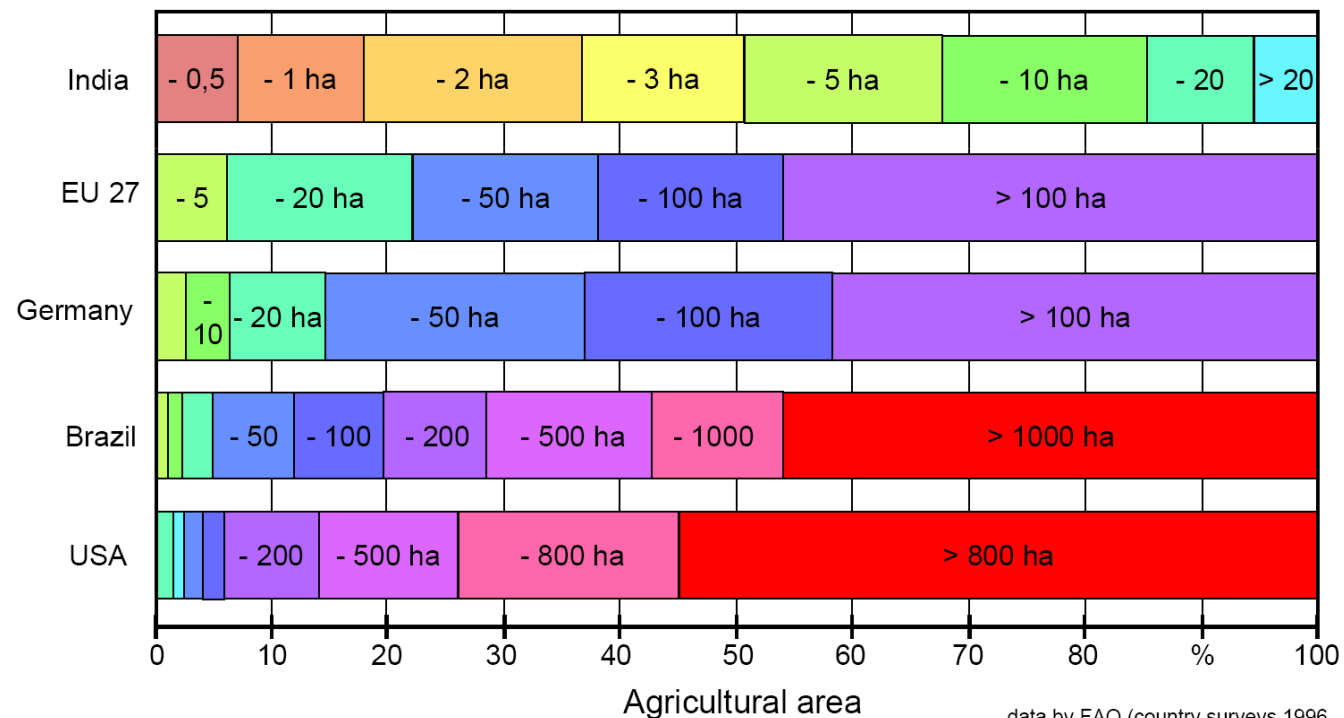
1. Major challenges for agriculture - Rising global food commodity prices & supply volatility

MGI Commodity Price Index (years 1999–2001 = 100)¹



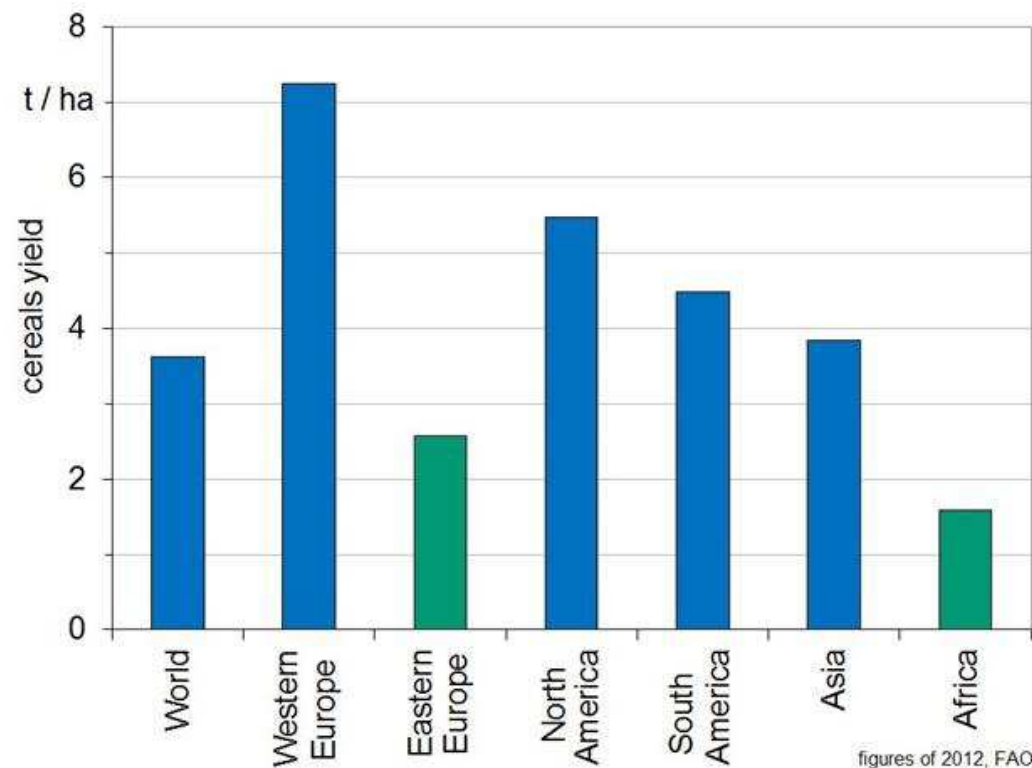
Source: McKinsey(2011)

1. Major challenges for agriculture - Farm size distribution and how technologies could be adapted to these various sizes



data by FAO (country surveys 1996, 1997, 2000, 2002), eurostat 2008

1. Major challenges for agriculture - Different agro-climatical and technological levels: Yields of main crops



- Cereal yields are reflecting, beside agro-climatical conditions, also the overall development of the farming systems: **Mechanization and other farm inputs.**

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China, beware



The leaders meet,
the cities grow,
the peasants are
left behind

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- 2. Agricultural mechanization survey: Data sources and their limitations**
3. Overview of agricultural mechanization in different regions of the world
4. Future trends and evolution of agricultural mechanization
 - Impact factors/drivers
 - Status and projection of agricultural mech. in surveyed regions
 - Cross regional comparison
5. Conclusions

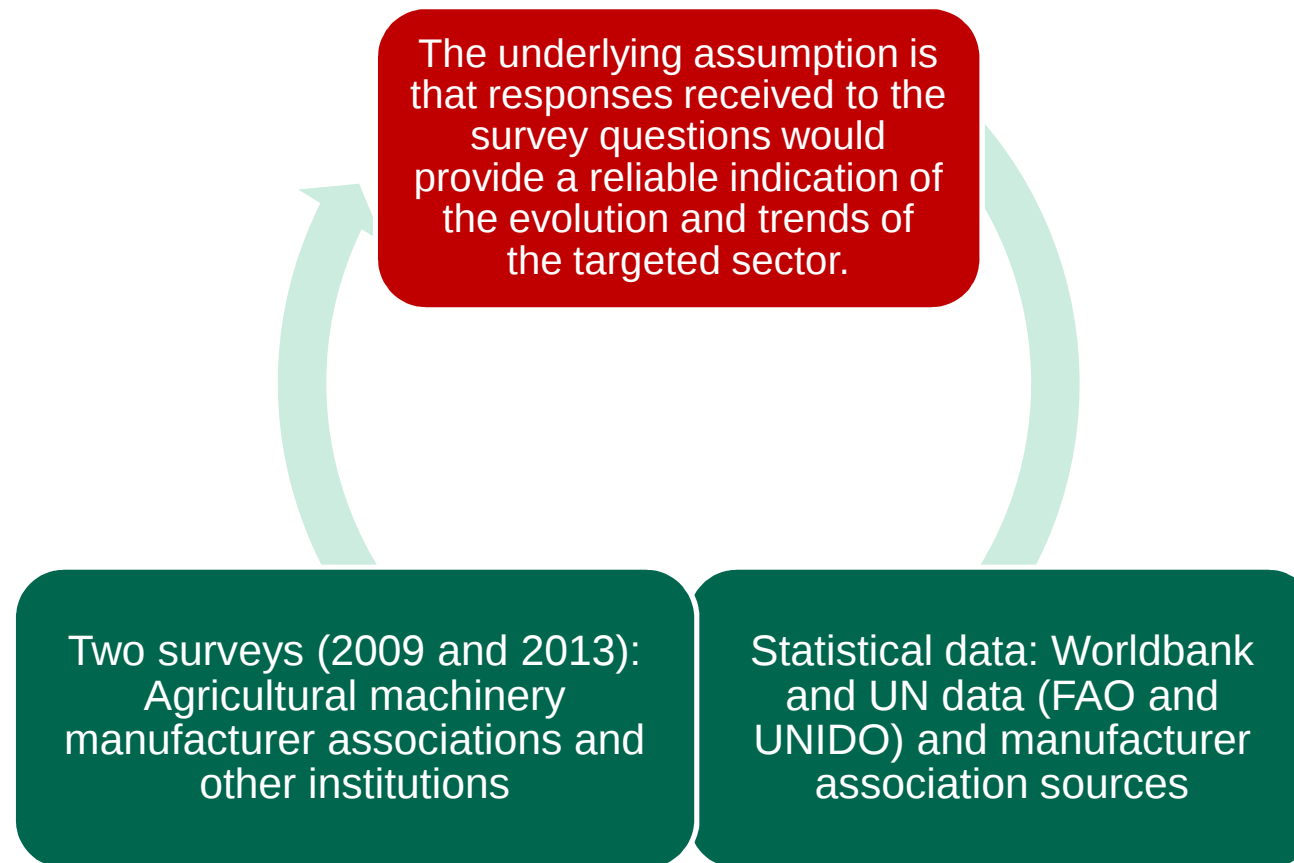


2. Global Agricultural mechanization survey – topics investigated

1. General development tendencies likely to affect the future demand of agri. Mech.
2. Most important staple crops and major drivers for mech. of such cropping systems
3. Trade related to agricultural machinery – including implements, tractors and combines
4. The impact that selected issues will have on the demand for agricultural mechanization
6. The technological trends for the sector over the next 10-20 years.



2. Global Agricultural mechanization survey: Data sources and their limitations

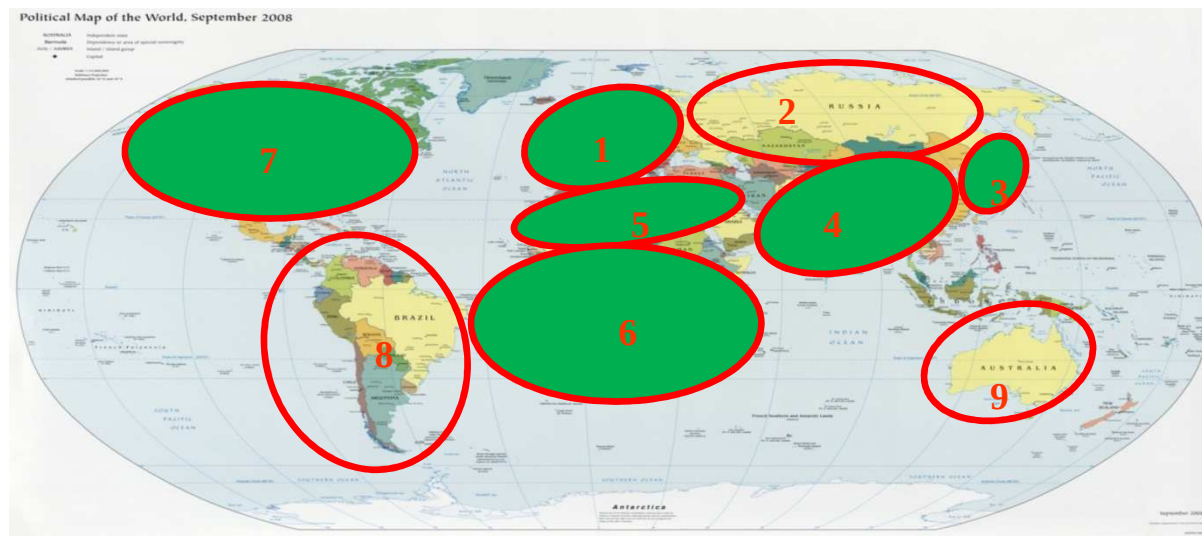


2. Global Agricultural mechanization survey: Data sources for 2013

Country	Association and/or Institution	Region
Germany	VDMA – Verband Deutscher Maschinen- und Anlagenbaue	European Union
Italy	UNACOMA – Unione Nazionale Costruttori Macchine per l'Agricoltura	
France	AXEMA – Union des Industriels de l'Agro-Equipement	
Finland	Federation of Finnish Technology Industries	
USA	AEM – Association of Equipment Manufacturers	North America
Japan	JFMMA – Japan Farm Machinery Manufacturer's Association	Japan
China	CAAMM – China Association of Agricultural Machinery Manufacturers	Asia
India	FICCI – Federation of Indian Chambers of Commerce and Industry IARI – Indian Agricultural Research Institute CIAE - Central Institute of Agricultural Engineering	
Morocco	Institut Agronomique et Vétérinaire Hassan II	
Cameroon	The University of Dschang	Sub-Saharan Africa
Botswana	Botswana College of Agriculture	
South Africa	SAAMA – South African Agricultural Machinery Association	

2. Global Agricultural mechanization survey: Limitations of the data

- Data availability
- Global perspective <> Regional / local accuracy
- Relatively limited response rate (questionnaire survey)



Respondents of the 2013 questionnaire survey



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- **Europe/EU**

- High numbers of machines per ha reflecting over mechanization and a great variety of farm structures
- Tendency to fewer and higher powered machines
- Strong industry with high rate of export

- **USA**

- Completely mechanized farms
- Trend towards larger and higher horsepower equipment
- Further technical progress tends towards automation



- **Japan**

- The agri. sector has been diminishing in recent decades (agricultural land, population working in agriculture, etc.).
- However, the sector is highly mechanized with about 461 tractors and 237 harvesters per 1,000 ha.
- Mostly small, sophisticated and specialized machines.
- Further technical progress tends towards more automation.
- Strong industry with export to whole Asia and other regions of the world.

- **India/China**

- Agriculture contributes large shares to the GDP and more than one third of the population gains income from agriculture.
- Small scale farm operations (~ 0,5 to 1.5 ha) are predominant.
- Structural change with tendencies to larger farms is increasing.
- Rapid increase in number of machines and of mech. custom-hire services.
- Fast growing tractor production: from 2002/03 to 2007/08 the production capacity doubled to reach 364,205 units in India.

- **North Africa / Middle East**

- The levels of mechanization are significantly higher than SSA. The average number of tractors per 1000 ha is 11.
- Large disparities can be observed in the region, for example:
 - in Morocco the Nbr of tractors per 1,000 ha averages 6.
 - in Egypt the data observed are on avg 31 tractors.

- **Sub-Saharan Africa**

- Land productivity is the lowest in the world. Average grain and maize yields range at about 1 ton/ha.
- 80% of agricultural area cultivated with only human power.
- 5% of agricultural area with tractor.
- 70% of all tractors are in South Africa and Nigeria.
- Increasing imports from India and China.





1. Major challenges for agriculture
2. Agricultural mechanization survey: Data sources and their limitations
3. Overview of agricultural mechanization in different regions of the world
4. **Future trends and evolution of agricultural mechanization:**
Survey results:
 - Impact factors/drivers
 - Status and projection of agricultural mech. in surveyed regions
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Impact Factors/Divers on the demand of agri. mechanization *

Natural conditions	Low (+/-)
Climate change	Low (+/-)
Land (availability, condition)	Low (+/-)
Water availability	Med. (+/-)

Political conditions	Medium (+)
Food safety goals	Low (+)
Education of farm operators	Med. (+)
Research	Low (+)
Subsidies	Med. (-)
Farm structure development	Med. (+)
Biofuel production	Low/Med. (+)

Economic conditions	Strong (+/-)
Technical progress	Med./Strong (+)
Economic growth and welfare	Med. (+)
Oil price	Med. (+/-)
Economic crises,	Med. (-)
Energy supply	Med. (+/-)

Demographic conditions	Med. (+/-)
Population growth	Med. (+)
Population age in rural areas	Med. (+/-)
Change in diets, consumer concerns	Low (+)
Urbanization and industrialization	Med. (+)

* Values for all 8 surveyed countries

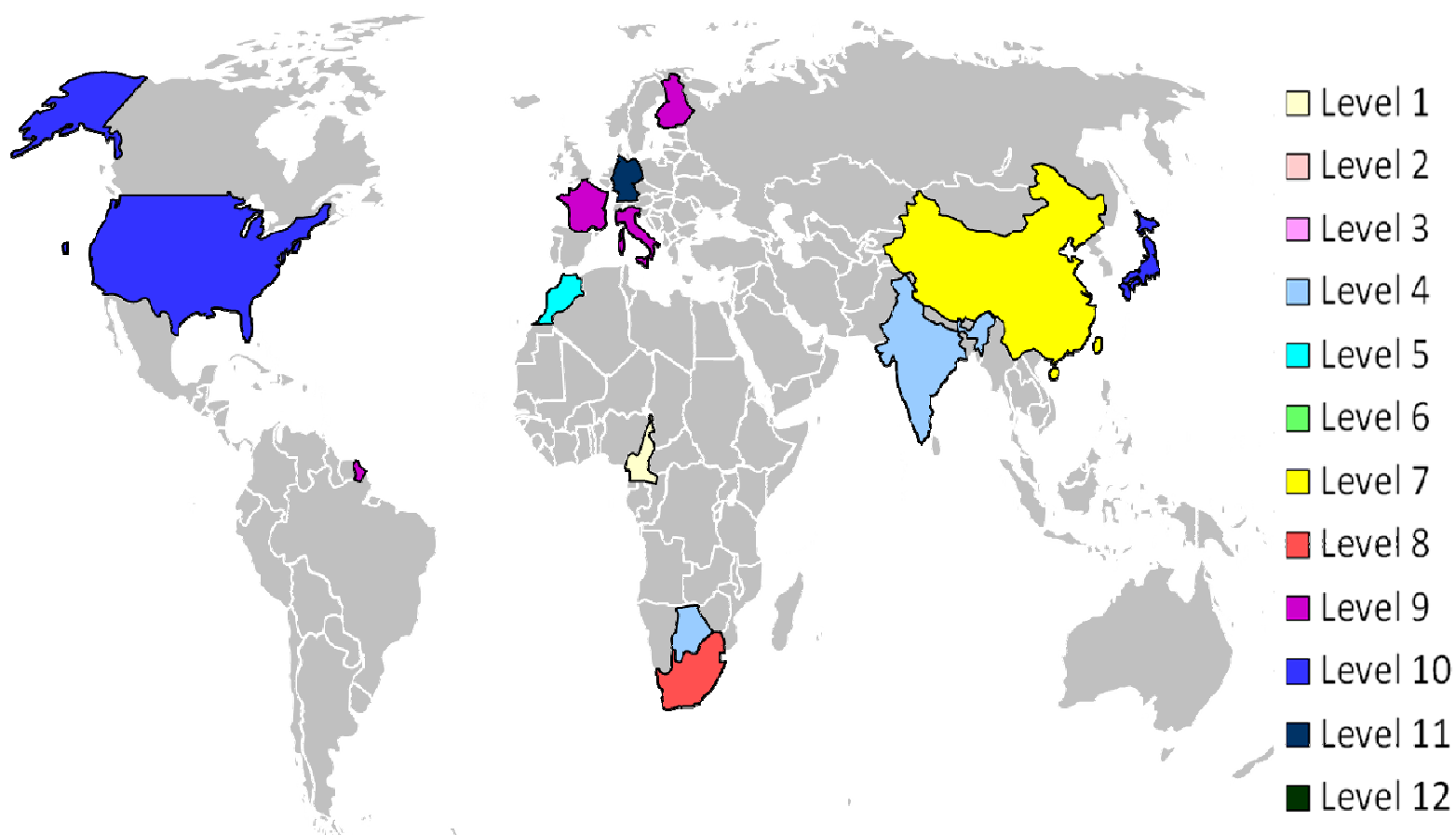
Status and projection of agr. mechanization in surveyed regions: *Twelve levels of agricultural mechanization*

Level	Farm power characteristics	hand	Draught animal	tractors					
1	Predominantly hand power	> 80	<= 20	<= 5					
2	Significant use of draught animal power	46 – 80	21 – 39	<= 10					
3	Significant use of tractors	15 – 45	>= 40	<= 19					
4	Tractors predominant	20 – 50	15 – 30	20 - 49					
5	Fully motorized technology level I	<= 25	<= 25	50 - 75	Nomin. speeds (km/h)		No. of speeds	Shift	PTO speeds rpm
					forw.	rev.	forw./rew.		
6	Fully motorized technology level II	<= 10	<= 10	> 75	2 – 20 (25)	3 - 8	6/2 – 8/2	SG, CS	540
7	Fully motorized technology level III	“	“	“	2 - 30	3 - 10	8/4 – 12/4	CS, SS	540/(1000)
8	Fully motorized technology level IV	“	“	“	(0,5) 2 – 30 (40)	3 - 15	12/4 – 16/8	SS, HL	540/1000
9	Fully motorized technology level V	“	“	“	(0,3) 2 – 40 (50)	2 - 20	16/12 – 36/36	SS, PPS, FPS	540/1000
10	Fully motorized technology level VI	“	“	“	0 – 50 (60)	0 - 25	∞	autom.	(750/1250)
11	Moderate share of autonomous vehicles								
12	Significant share of autonomous vehicles								

Source: Clarke et al. (2002) / Renius (2005), modified.

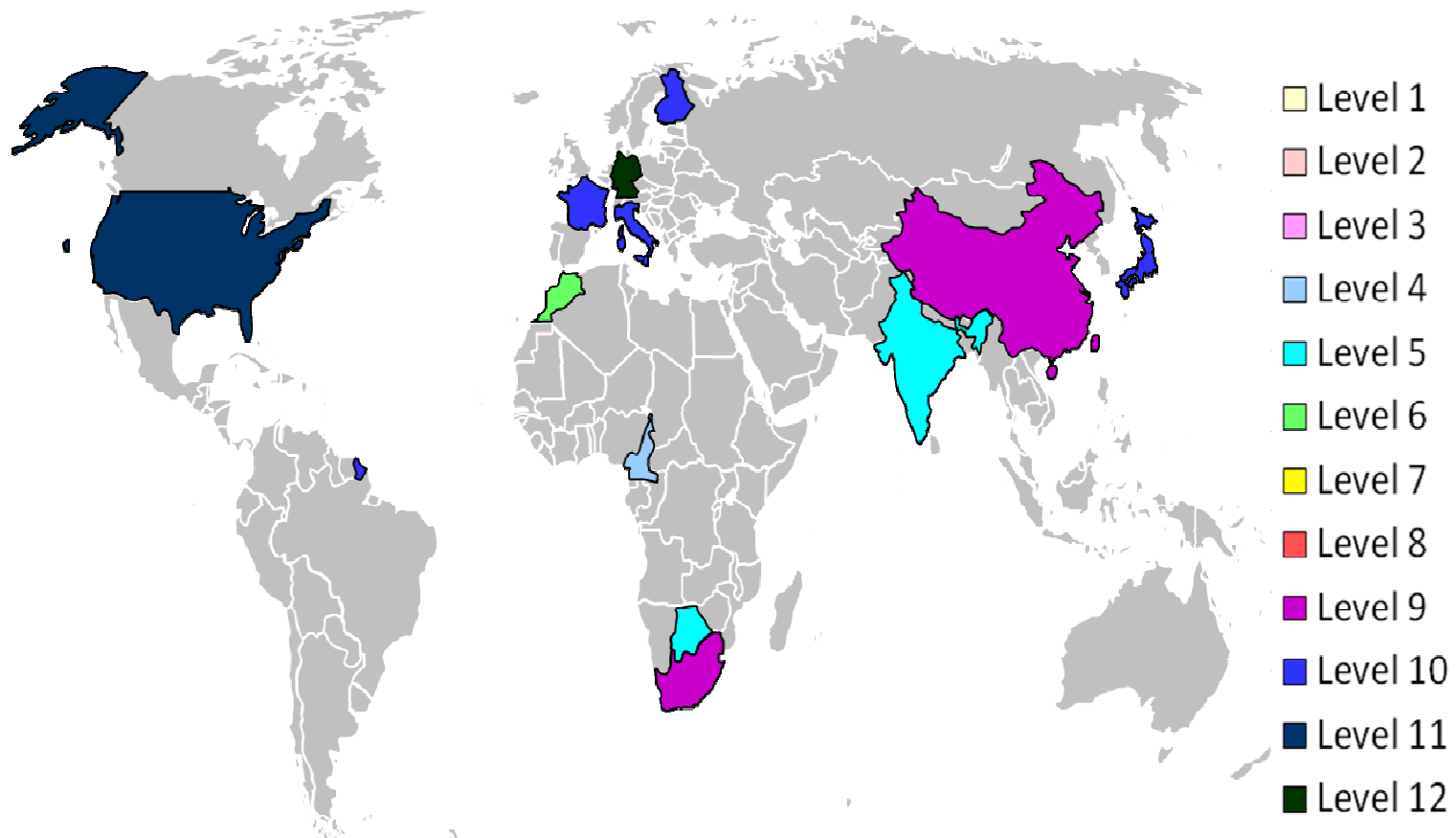
Status and projection of agr. mechanization in surveyed regions: Current status (2013)

Agricultural mechanization: Status



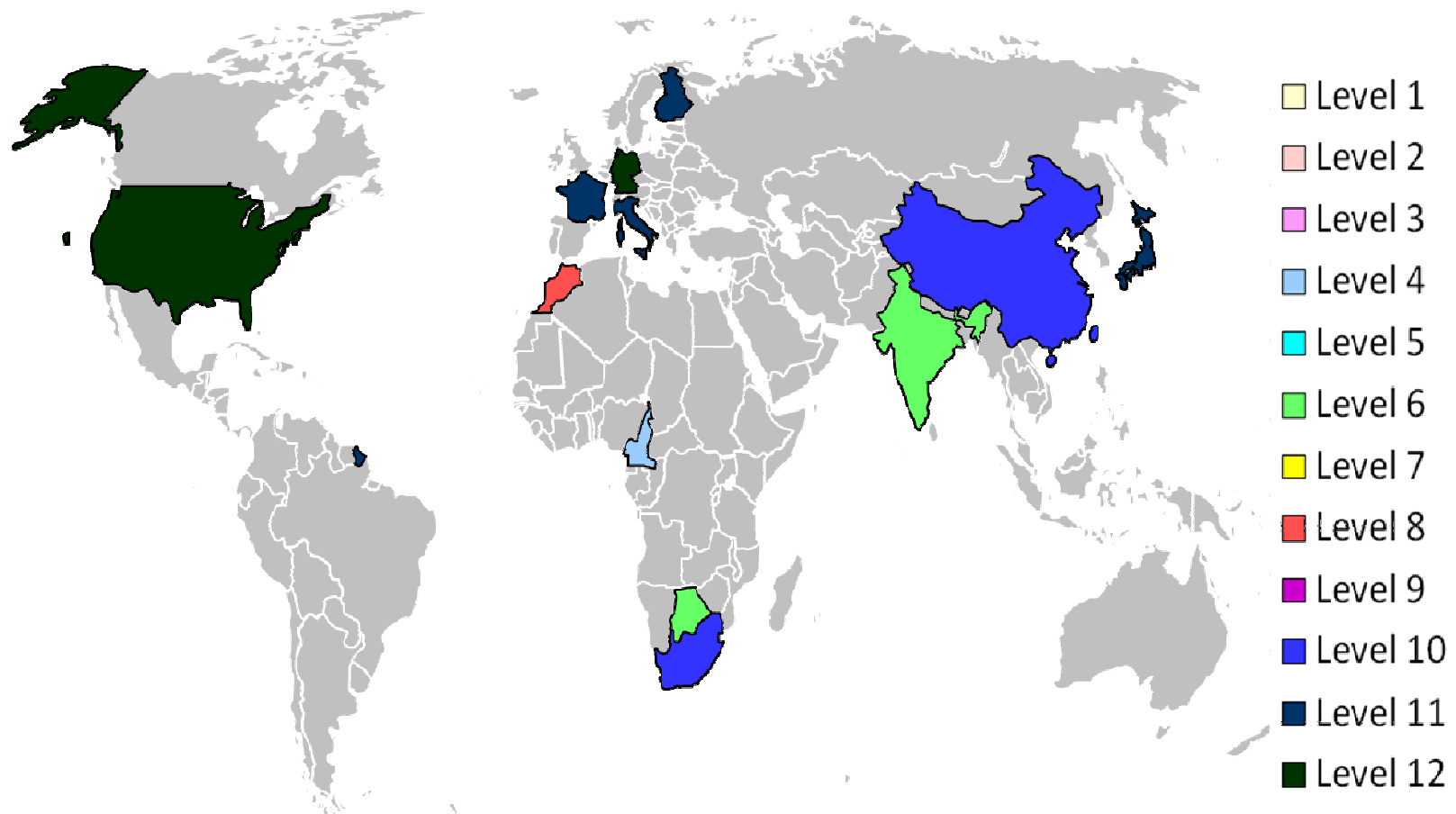
Status and projection of agr. mechanization in surveyed regions

Agricultural mechanization: 10 years prediction

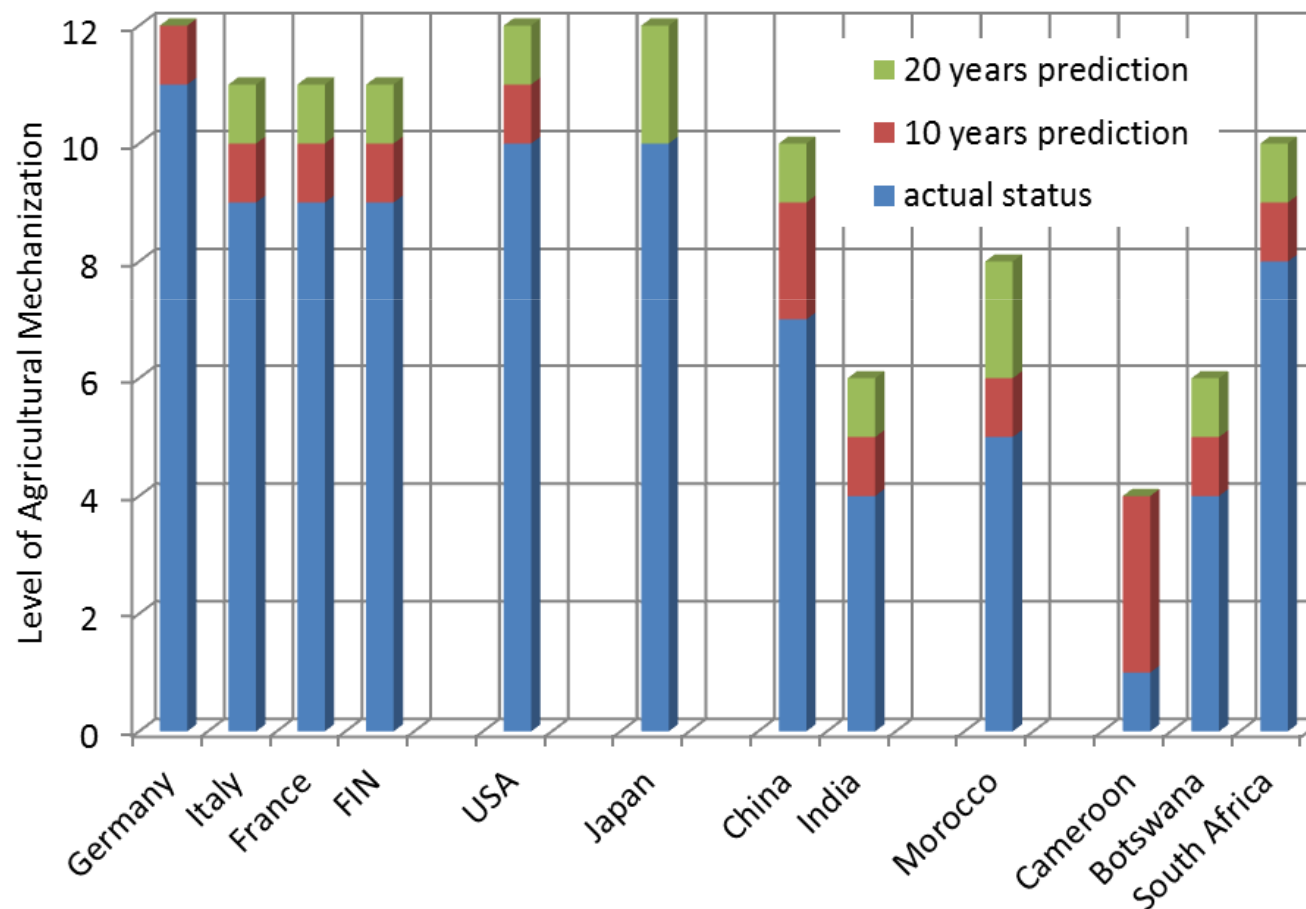


Status and projection of agr. mechanization in surveyed regions

Agricultural mechanization: 20 years prediction



Status and projection of agr. mechanization in surveyed regions



Cross regional comparison: Domestic demand over the next 10 years

	Germany	Italy	France	Finland	USA	Japan	China	India	Morocco	Cameroon	Botswana	South Africa
Small size tractors (≤ 40 hp)	→	↗	↗	↗	↗	↘	↗	↗	→	↗	↗	→
Medium size tractors (≤ 100 hp)	→	↗	↗	↘	↗	↗	→	↗	↑	↗	↗	↗
Big size tractors (> 100 hp)	↗	↗	↗	↗	↗	↗	↑	/	↗	↗	↗	↗
Spare parts for tractors	→	↗	↗	→	↗	↗	↗	↗	↑	↑	↑	↗
Self propelling combines	→	↗	→	↘	↗	↗	→	↗	↗	↗	↗	↗
Forage harvesters	→	↗	→	→	↗	→	↑	↗	↗	→	↗	↗
Reapers	→	↗	→	→	/	/	→	↗	↗	↗	↗	↗
Threshers	/	↗	→	/	/	↘	↘	↗	↗	↑	↗	↗
Irrigation systems	→	↗	↗	↘	↑	↘	↗	↗	↑	↗	↑	↗
Diesel engines	→	↗	↗	↘	↗	↘	↗	↗	↑	↗	↑	↗
Power tillers	→	↗	→	→	→	↘	→	↗	↑	↗	↑	↗
Food processing technique	→	↗	→	→	↗	/	↗	↑	↑	↗	↗	↗
Spare parts in general	→	↗	↗	↗	↗	↘	→	↗	↑	↑	↑	↗
Hand implements	/	/	→	↘	↘	/	→	↗	→	↑	↑	↗
Draught animal implements	/	/	→	/	/	/	/	→	/	↗	↑	↗
Soil preparation	→	-	↗	↗	↗	→	→	↗	↗	↗	↑	↗
Seeding	→	-	↗	↗	↗	→	→	↗	↗	↗	↑	↗
Plant protection	→	-	↗	↗	↗	→	↗	↗	↗	↗	↑	↗

Legend

[↑] $\geq 10\%$ annual growth rate	[↘] -10% to 0 % annual growth rate	[-] not specified
[↗] 0% to 10% annual growth rate	[↘] $\leq -10\%$ annual growth rate	
[→] $\pm 0\%$ annual growth rate	[/] not relevant	

Cross regional comparison: Import dev. over the next 10 years

	Germany	Italy	France	Finland	USA	Japan	China	India	Morocco	Cameroon	Botswana	South-Africa
Small size tractors (≤ 40 hp)	↗	↗	↗	↗	↗	↗	↓	→	→	↗	↑	→
Medium size tractors (≤ 100 hp)	↗	↘	↗	↘	↗	↗	↓	→	↑	↗	↑	↗
Big size tractors (> 100 hp)	↗	↘	↗	→	→	↗	→	/	↗	↗	↑	↗
Spare parts for tractors	→	↗	↗	→	↗	↗	→	→	↑	↑	↑	↗
Self propelling combines	→	↘	→	↘	→	→	→	→	↗	↗	↑	↗
Forage harvesters	→	↘	→	↗	→	→	↗	-	↗	→	↑	↗
Reapers	→	↘	→	↘	/	/	→	-	↗	↗	↑	↗
Threshers	/	↘	→	/	/	/	→	-	↗	↑	↑	↗
Irrigation systems	→	↘	→	↘	→	→	↗	-	↑	↗	↑	↗
Diesel engines	→	↗	↗	↘	→	→	→	-	↑	↗	↑	↗
Power tillers	→	↘	→	↘	→	↘	→	↑	↑	↗	↑	↗
Food processing technique	→	↘	→	→	↗	/	→	↗	↑	↑	↑	↗
Spare parts in general	→	↘	↗	↗	→	↗	→	-	↑	↑	↑	↗
Hand implements	/	/	→	↘	↗	/	/	→	→	↗	↑	→
Draught animal implements	/	/	→	/	-	/	/	→	/	↗	↑	→
Soil preparation	→	-	↗	→	↗	/	→	→	↗	↗	↑	↗
Seeding	→	-	↗	↗	↗	→	→	→	↗	↗	↑	↗
Plant protection	→			↗	↗	→	↗	→	↗	↗	↑	↗

Legend

[↑] $\geq 10\%$ annual growth rate

[↗] 0% to 10% annual growth rate

[→] $\pm 0\%$ annual growth rate

[↘] -10% to 0 % annual growth rate

[↓] $\leq -10\%$ annual growth rate

[/] not relevant

[-] not specified

Cross regional comparison: Export dev. over the next 10 years

	Germany	Italy	France	Finland	USA	Japan	China	India	Morocco	Cameroon	Botswana	South Africa
Small size tractors (≤ 40 hp)	→	↘	↗	/	↑	↗	↑	↗	/	/	→	/
Medium size tractors (≤ 100 hp)	→	↗	↗	→	↑	→	↑	↗	/	/	→	/
Big size tractors (> 100 hp)	↗	↗	↗	↗	↑	→	↗	/	/	/	→	/
Spare parts for tractors	→	↗	↗	→	↑	→	↗	↗	/	/	→	/
Self propelling combines	↑	↗	→	↗	↑	↘	↗	↗	/	/	→	/
Forage harvesters	↑	↗	→	→	↗	→	→	↗	/	/	→	/
Reapers	→	↗	→	→	/	/	→	-	/	/	→	/
Threshers	/	↗	→	/	/	→	→	-	/	↗	→	↗
Irrigation systems	→	↗	↑	→	↗	→	→	↗	/	→	→	↗
Diesel engines	→	↗	↗	↗	↗	↗	→	↗	/	-	→	/
Power tillers	→	↗	↗	/	↗	↗	→	-	/	-	→	/
Food processing technique	↗	↗	↑	→	↗	/	→	↗	/	↗	→	↗
Spare parts in general	↗	↗	↗	→	↗	↗	→	↗	/		→	/
Hand implements	/	/	↗	→	↘	/	→	↗	/	↗	→	↗
Draught animal implements	/	/	↗	/	/	/	/	↗	/	↗	→	↗
Soil preparation	↗	-	↗	↗	↗	/	→	↗	/	→	→	↗
Seeding	↗	-	↗	→	↗	→	→	↗	/	→	→	↗
Plant protection	↗	-	↗	→	↗	→	↗	↗	/	→	→	/

Legend

[↑] $\geq 10\%$ annual growth rate

[↗] 0% to 10% annual growth rate

[→] $\pm 0\%$ annual growth rate

[↘] -10% to 0 % annual growth rate

[↓] $\leq -10\%$ annual growth rate

[/] not relevant

[-] not specified



Cross regional comparison: Market penetration of selected technologies

		Precision farming													
		Overall	Tillage	N-fertilizer application	Other fertilizer application	Plant	Guidance systems	Yield mapping	Driverless tractors	Fleet management	Smart implements	ISOBUS	Remote diagnostics	Use of sensor technology	Robotics
Germany	status	4	5	5	5	5	4	4	1	2	1	3	3	4	3
	10 years	5	5	5	5	5	5	5	1	5	2	4	4	5	4
Italy	status	2	2	-	-	4	2	2	1	2	1	1	1	1	1
	10 years	3	3	-	-	5	3	3	2	2	2	3	3	2	2
France	status	2	1	2	1	2	1	2	1	2	2	2	1	2	1
	10 years	3	2	4	3	4	3	4	2	3	4	4	3	4	2
Finland	status	2	1	2	2	1	2	2	1	1	2	2	1	2	1
	10 years	3	2	3	3	4	5	3	1	2	4	4	4	4	2
USA	status	5	5	5	5	5	5	4	1	3	2	2	3	3	2
	10 years	5	5	5	5	5	5	5	3	4	4	4	5	5	4
Japan	status	1	5	1	5	5	2	1	1	-	-	1	1	1	2
	10 years	3	5	1	5	5	3	1	1	-	-	4	2	3	3
China	status	1	1	4	4	3	1	1	1	1	1	1	1	1	1
	10 years	3	2	5	5	5	2	2	2	3	3	3	2	3	2
India	status	1	3	4	2	3	1	1	1	1	1	1	1	1	1
	10 years	2	4	5	3	4	1	1	1	1	2	1	1	1	1
Morocco	status	1	4	3	3	3	1	1	1	1	1	1	1	1	1
	10 years	2	5	4	4	4	2	2	1	2	2	2	2	2	2
Cameroon	status	1	2	1	1	1	1	1	1	1	1	1	1	1	1
	10 years	1	2	2	2	1	1	1	1	1	1	1	2	2	1
Botswana	status	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	10 years	2	3	3	2	3	1	2	1	1	1	1	1	1	1
South Africa	status	3	5	5	5	5	2	2	1	1	1	1	1	1	1
	10 years	4	5	5	5	5	3	3	2	2	2	3	3	3	2

Legend:

1

2

3

4

5

Market
penetration:

0 to 2 %

2 to 10 %

10 to 30 %

30 to 50 %

> 50 %



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Conclusions

General and Developed Economies

- The need for further mechanization to improve productivity in agriculture and to feed the world is undisputable in particular in the light of expected demographic developments.
- The political conditions and also expected socio-development factors seem to be very favorable for investments in agricultural mechanization.
- The use of precision farming will become standard in the short to the mid-term range, but also the use of control and automation systems will become common and offer new growth opportunities for the corresponding industries.
- Nevertheless, the quantitative saturation of domestic markets with a large number of different agricultural implements will force the industry to open potentials abroad.

Conclusions

Transition Economies

- The emerging countries such as India, China and South-Africa are seeing significant economic growth with associated technology transfer and progress in agricultural production.
- They are becoming important players on the world markets for agricultural machinery and also represent promising markets with high demands for further mechanization.
- Strong advances towards high levels of mechanization can be expected. However, this support that:
 - ✓ the current trends of technology transfer is pursued as part, for example of joint-ventures.
 - ✓ issues like e.g. property rights, taxation practices across countries, market access, etc. are further dealt with.

Conclusions

Developing Economies

- The most challenging region for agricultural mechanization development remains Africa.
- While only limited progress has been achieved in terms of increased number of machines and market expansion, the predictions over the next ten years are positive.
- This supposes that increased investments are needed both from the national governments and the private sector to develop the sector.





**TOWARDS A COMPETITIVE
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**Thank you for
your attention**

