

Sustainable Agriculture Transformation in North and Central Asia

Patricia Wong Bi Yi

Associate Economic Affairs Officer
Subregional Office for North and Central Asia
UN ESCAP



Content

- Introduction
- Context of transformation in NCA
- Agriculture transformation and the 2030 Agenda
- Moving forward: Sustainable agriculture transformation

Introduction

- Agriculture transformation can be a potential driver for sustainable development in NCA
- Large share of agricultural work force, low levels of productivity
- Complementary opportunities provided in developing agriculture sector

Objectives

- Ascertain past relationship among variables of agriculture transformation in NCA
- Examine linkages between agriculture transformation and SDG indicators
- Provides recommendations that facilitate sustainable intra-sectoral transformation

Context

STRUCTURAL TRANSFORMATION

Context

1991-2001

Decentralization

- productivity levels
- per capita income
- + inflation
- > privatization
- > liberalize trade
- > export diversification

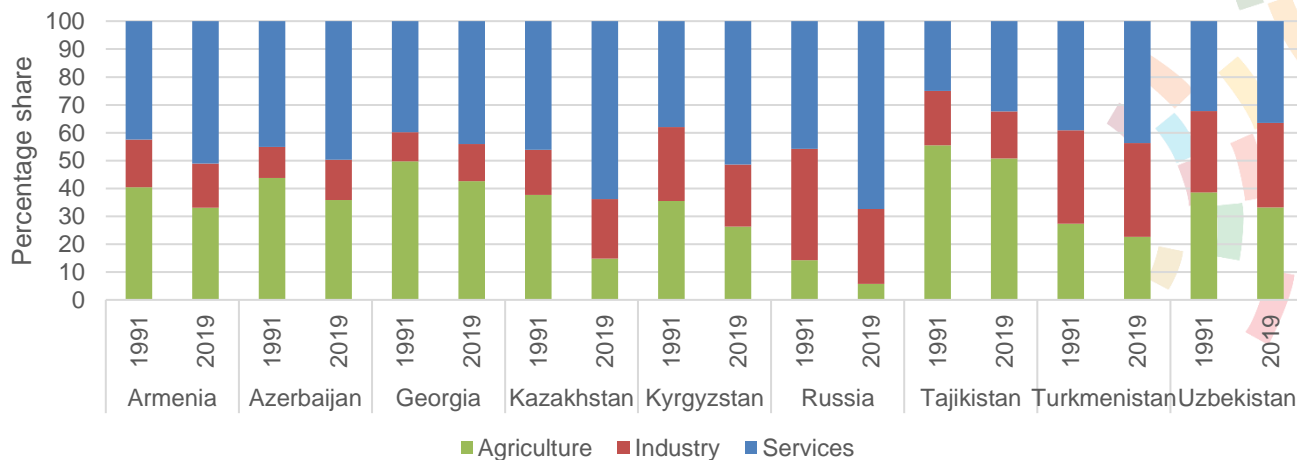
2001-2019

Within sector
improvements

- + productivity levels
- + income levels
- > price fluctuations
- > environmental impacts
- > limited employment

Context

Employment share by sector, 1991 and 2019

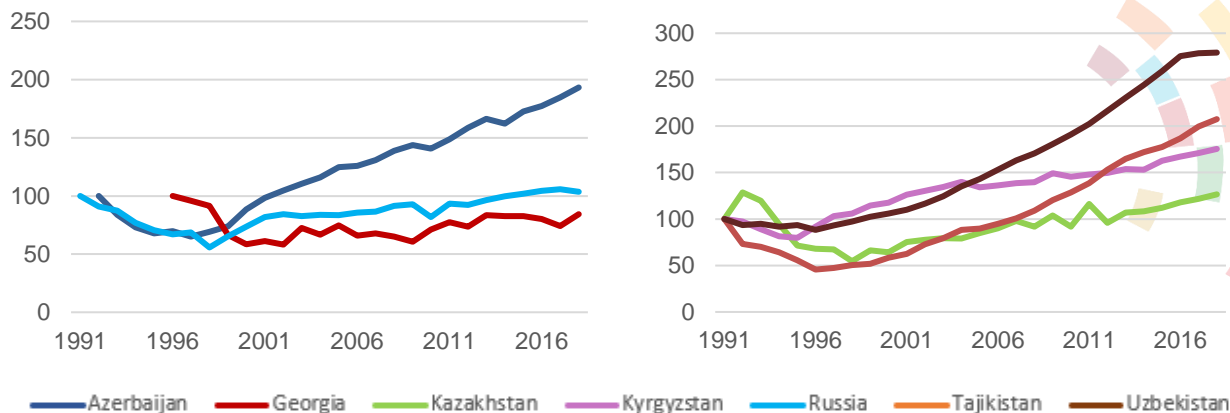


Source: World Development Indicators, World Bank

Context

Agriculture transformation

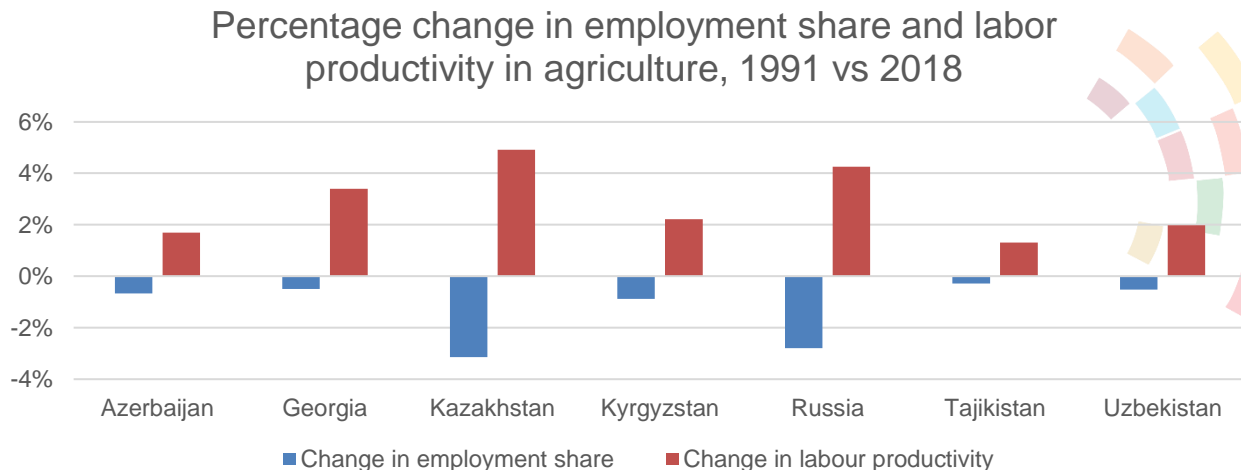
Agriculture value added in North and Central Asia (constant USD 2010),



Source: World Development Indicators, World Bank

Context

Agriculture transformation



Source: World Development Indicators, World Bank

Context

Agricultural production composition

Achieve
balanced
diets

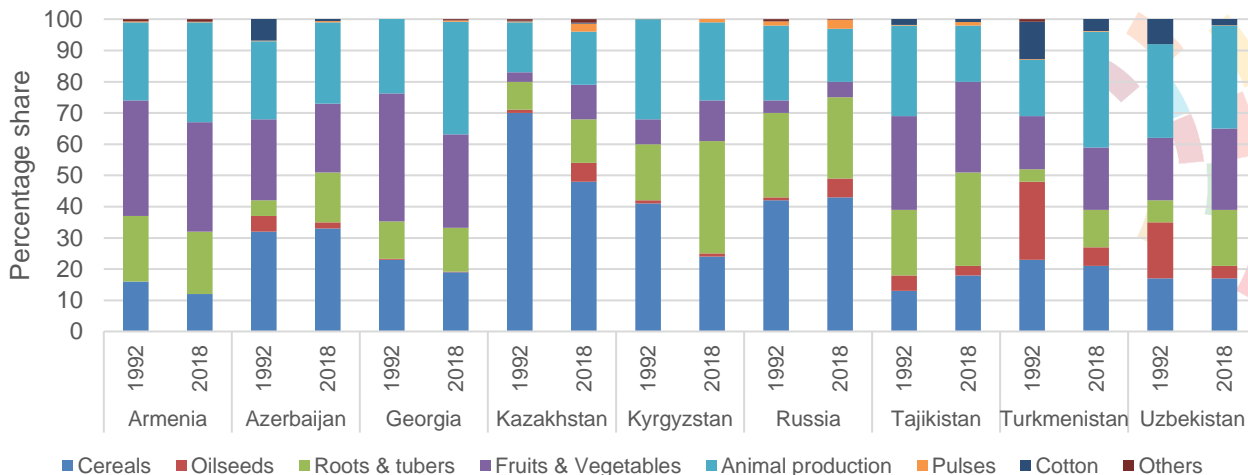
Product
diversification

Export
orientation
strategies

Context

Agricultural production composition

Share in agricultural output by country (%), 1992 and 2018



Source: FAOstat

Context

Diversification into new export products, 2002-2017

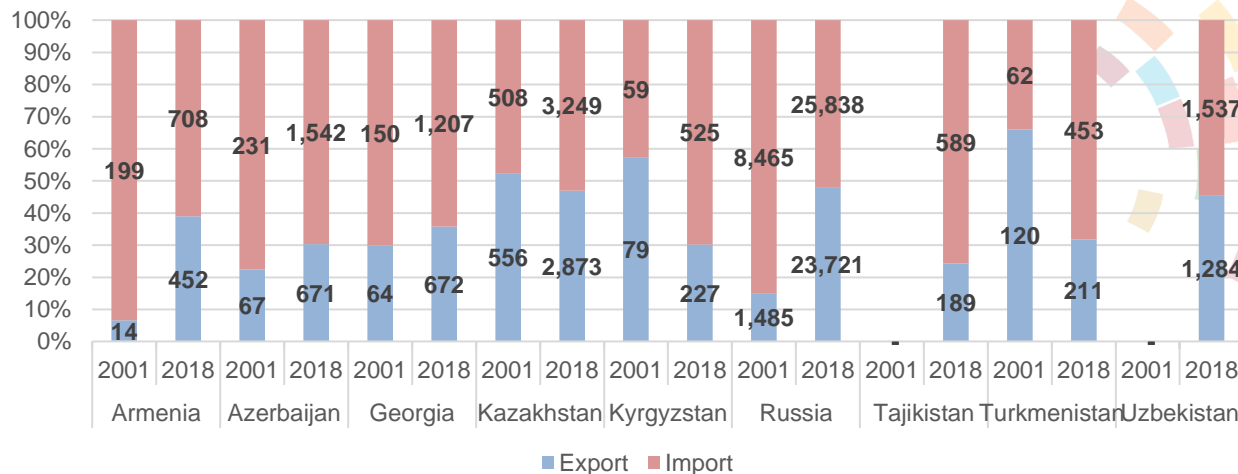
Country	# new products	Total value of new products (USD)	Share of agriculture-related products (%)	Value of agriculture related products (USD)
Armenia	16	91.5 mil	98.9	90.5 mil
Azerbaijan	5	86.4 mil	58.16	50.3 mil
Georgia	36	479 mil	20.35	97.5 mil
Kazakhstan	14	707 mil	60.17	425.4 mil
Kyrgyzstan	22	110 mil	10.43	11.5 mil
Russia	18	5.09 bil	47.18	2.4 bil
Tajikistan	10	226 mil	16.55	37.4 mil
Turkmenistan	2	17.6 mil	0	-
Uzbekistan	28	687 mil	4.75	32.6 mil

Source: Atlas of Economic Complexity

Context

Agricultural trade and openness

Volume of agriculture-related trade (USD million)

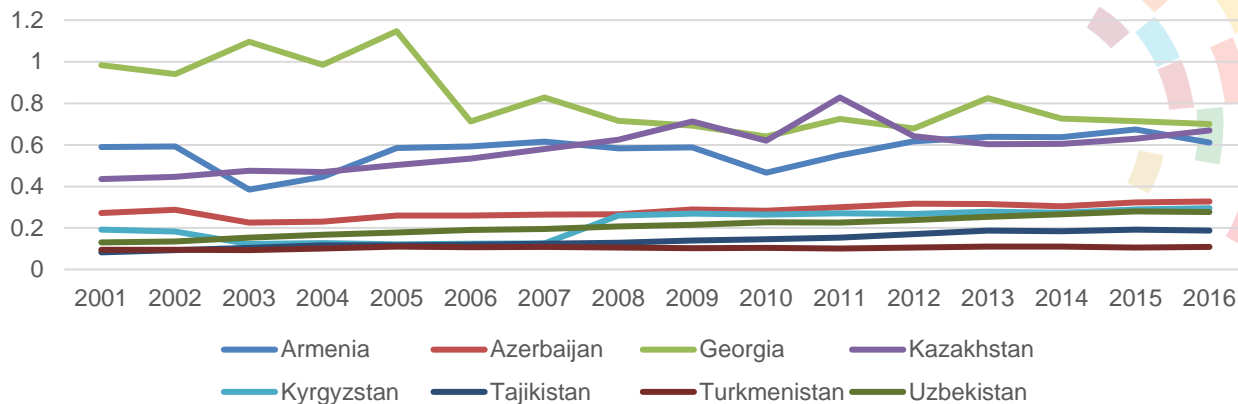


Source: International Trade Center

Context

Agricultural water productivity

Agriculture water productivity, 2001-2016



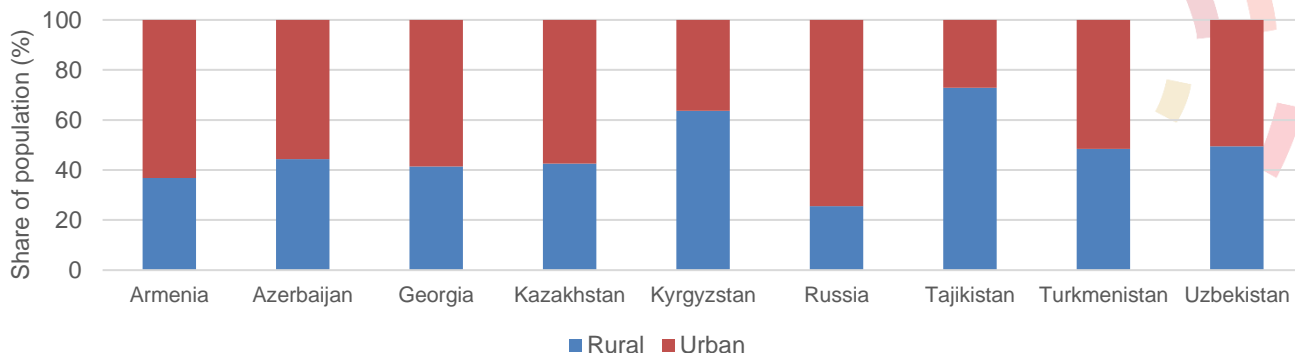
Source: ESCAP calculations based on AQUASTAT & USDA data

Agriculture water productivity =
gross agriculture output (USD)/ water withdrawals in agriculture (cubic meter)

Agriculture transformation & the 2030 Agenda

Rural development

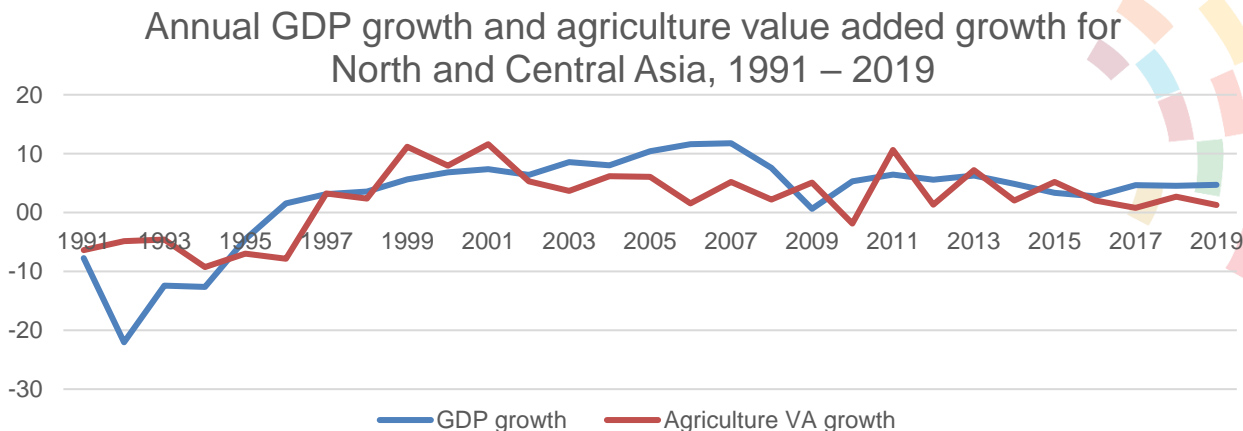
Share of rural and urban population in North and Central Asia, 2018



Source: World Development Indicators, World Bank

Agriculture transformation & the 2030 Agenda

Economic development



Source: World Development Indicators, World Bank

Agriculture transformation & the 2030 Agenda

Social development

Achieve
food
security

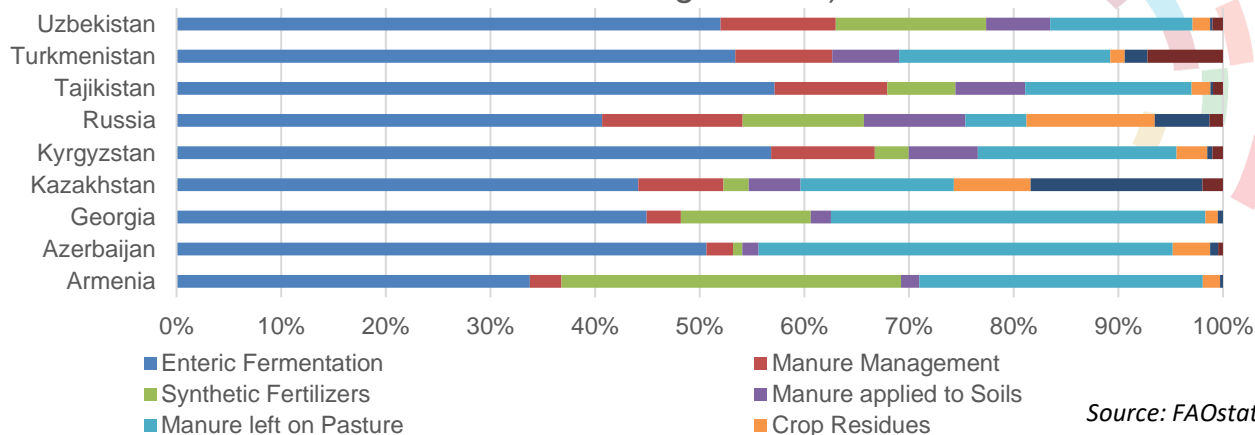
Eradicating
hunger &
malnutrition

No poverty

Agriculture transformation & the 2030 Agenda

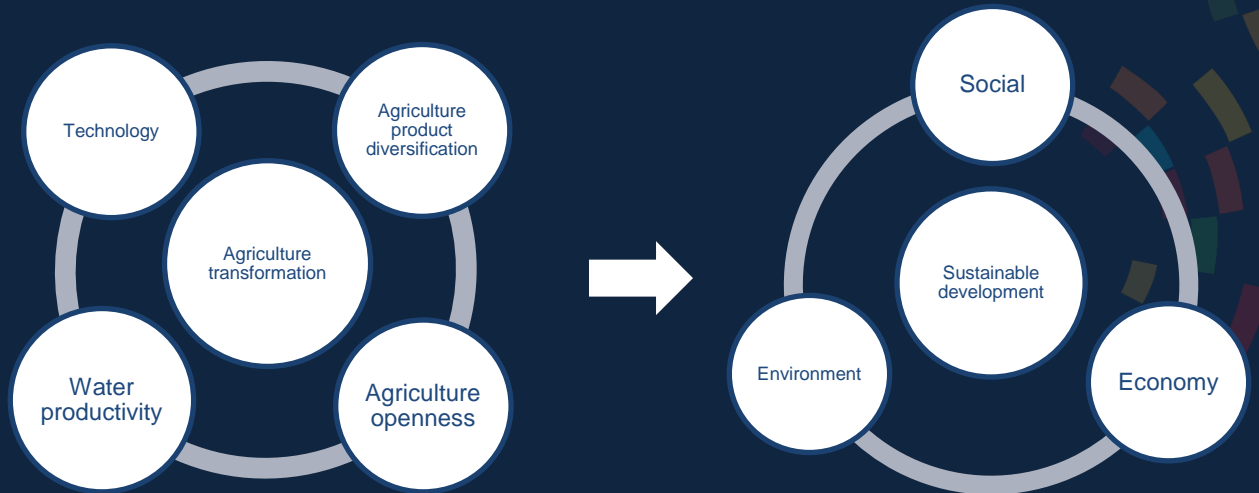
Environmental development

Causes of emissions in agriculture, 2017 (percentage of total emissions in agriculture)



Source: FAOstat

Agriculture transformation & the 2030 Agenda



Agriculture transformation & the 2030 Agenda

Conceptual framework

2-step approach

$$(i) \quad AT_{it} = x_0 + x_1 WP_{it-1} + x_2 AD_{it-1} + x_3 AO_{it-1} + x_4 T_{it-1} + \mu_{it} + \varepsilon_{it}$$

$$(ii) \quad SDG_{it} = x_0 + x_1 AT_{it-1} + \mu_{it} + \varepsilon_{it}$$

AT_{it} = agriculture productivity

WP_{it-1} = lag of water productivity

AD_{it-1} = lag of agriculture diversification

AO_{it-1} = lag of agriculture openness

T_{it-1} = technology

μ_{it} = covariates

ε_{it} = error term

SDG_{it} = sustainable development indicator

Agriculture transformation & the 2030 Agenda

Measurement for agriculture transformation

$$(i) AT_{it} = x_0 + x_1 WP_{it-1} + x_2 AD_{it-1} + x_3 AO_{it-1} + x_4 T_{it-1} + \mu_{it} + \varepsilon_i$$

Changes in agriculture productivity is used as a proxy for agriculture transformation and is influenced by water productivity, agriculture product diversification and agriculture openness and technology.

Additional variables and covariates include share of livestock in agriculture sector, arable land, temperature change, water withdrawals, rural population, official flows to ag.

Agriculture transformation & the 2030 Agenda

Measurement for sustainable development

$$(ii) \text{SDG}_{it} = x_0 + x_1 \text{AT}_{it-1} + \mu_{it} + \varepsilon_{it}$$

- Economic development: GDP growth, GDP per capita, GDP per person employed, unemployment
- Social development: undernourishment, poverty, mortality, school enrolment
- Environmental development: CO2 emissions, greenhouse gas emissions from agriculture, carbon stock, freshwater biodiversity

Expert Group Meeting

Sustainable Agriculture Transformation in North and Central Asia

	Pooled OLS				Fixed Effects			Random Effects		
	ΔTFP	ΔLP	ΔTFP	ΔLP	ΔTFP	ΔLP	ΔTFP	ΔLP	ΔTFP	ΔLP
ΔTFP_{t-1}	-0.417*** (0.089)		-0.454*** (0.104)		-0.417*** (0.090)		-0.455*** (0.107)		-0.442*** (0.084)	
ΔLP_{t-1}		-0.300*** (0.112)		-0.339** (0.123)		-0.361*** (0.108)		-0.386*** (0.109)		-0.357*** (0.089)
$\ln AO_{t-1}$			1.559 (1.178)	2.656 (1.979)			10.153*** (3.626)	15.545*** (4.392)		
ΔWP_{t-1}	-2.635 (5.711)	-6.707 (6.016)	-5.205 (5.961)	-9.914 (7.687)	-1.727 (6.258)	-2.656 (7.429)	-3.850 (6.482)	-6.478 (7.308)		
AD_{t-1}	3.922*** (1.313)	4.691** (1.898)			5.580** (2.297)	9.624*** (2.309)			3.825** (1.535)	4.504** (2.011)
$\Delta Machines$	-20.605*** (4.889)	-2.399 (7.690)	-20.988*** (6.286)	1.132 (8.635)	-19.871*** (6.090)	-1.058 (7.891)	-22.685*** (5.072)	-4.703 (5.920)	-20.912** (8.941)	-2.976 (11.586)
$\ln Land$			0.300 (0.394)	1.124** (0.555)			23.979*** (7.782)	36.001*** (9.869)		
$Animal\ share$	-21.276*** (5.405)	-22.978*** (7.986)	-13.910*** (5.260)	-16.731** (7.372)	-27.119*** (8.639)	-38.716*** (9.298)	-29.500*** (8.799)	-39.841*** (10.444)	-21.405*** (5.945)	-23.434*** (7.783)
Constant	4.042 (3.024)	7.712* (3.996)	8.021 (5.677)	7.299 (8.068)					3.612 (2.968)	6.838* (3.889)
Covariates included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.344	0.250	0.297	0.238	0.365	0.364	0.401	0.381	0.340	0.234
$Adj.\ R^2$	0.291	0.189	0.242	0.178	0.264	0.262	0.298	0.275	0.305	0.194
Num. obs.	81	81	83	83	81	81	83	83	81	81

Agriculture transformation & the 2030 Agenda

Analyzing agriculture transformation & sustainable development

Summarizing results of analyzing variables for agriculture transformation

	Relationship	Significance
Agriculture diversification	Positive	Significant
Agriculture openness	Positive	Significant
Technology	Negative	Significant
Water productivity	Negative	Insignificant

Agriculture transformation & the 2030 Agenda

Analyzing agriculture transformation & sustainable development

Summarizing results of analyzing agriculture transformation & economic development

- Residuals exhibit positive and significant effects on GDP growth and GDP per capita growth
- Residuals exhibit negative and significant effects on youth unemployment



Agriculture productivity has not been a key driver of economic growth in the region

Agriculture transformation & the 2030 Agenda

Analyzing agriculture transformation & sustainable development

Summarizing results of analyzing agriculture transformation & social development

- Agriculture transformation exhibits negative and significant effects on prevalence of undernourishment
- Residuals exhibit negative and significant effects on poverty
- No significant influence on school enrolment & mortality rates



School enrolment and mortality rates, which are connected to improvements in the health care coverage and social systems, are only affected indirectly by agriculture

Agriculture transformation & the 2030 Agenda

Analyzing agriculture transformation & sustainable development

Summarizing results of analyzing agriculture transformation & social development

- Agriculture transformation exhibits negative and significant effects on greenhouse gas emissions in agriculture
- No significant influence on carbon stock, fresh water biodiversity, total CO₂ emissions



Majority of CO₂ emissions in NCA caused by other sectors. Results imply that agriculture transformation contributes to environmental sustainability.

Moving forward: Sustainable agriculture transformation

Key role of government

- Prioritizing environmental sustainability and resilience
- Development of inclusion policies that ensure just distribution of assets
- Regulation by sound democratic governance
- Providing incentives and promote R&D
- Partnerships

Moving forward: Sustainable agriculture transformation

Why prioritize SUSTAINABLE DEVELOPMENT?

- Climate change expected to negatively impact NCA countries (more than global average)
- Agriculture impact on land use accounts for approximately 23% of greenhouse gas emissions worldwide
- Agriculture transformation can promote inclusive development and employment opportunities in rural areas, especially for women (approximately 30% based on official statistics) & youth
- Opportunities in sustainable concept: organic agriculture, fair trade practices, social enterprise

Moving forward: Sustainable agriculture transformation

Lessons learned from COVID-19

- Importance of sanitary and regulatory compliance
- Information sharing and transparency
- Inclusion of smallholder agriculture producers
- Regional cooperation to facilitate supply chain resilience

Moving forward: Sustainable agriculture transformation

Recommendations

Diversify agriculture production

- Studies to identify profit driving crops and livestock products
- Reassess current agriculture subsidies structure to meet evolving development objectives

Facilitate agriculture trade & openness

- Upgrade infrastructure and explore intermodal transportation modalities
- Develop strategic economic corridors to stimulate agriculture activities with targeted investments and development plans

Moving forward: Sustainable agriculture transformation

Recommendations

Integrate digital technology and innovative solutions

- Integrate modern machineries in agriculture production processes
- Explore utilization of big data applications in agriculture processing and logistics
- Establishment of digital platforms for information sharing

Improve water productivity and water use efficiency

- Introduce approaches that increase resilience and productivity
- Modernization of irrigation systems

THANK YOU

WWW.UNESCAP.ORG



@SONCA_ESCAP



@SONCA.UNESCAP



UNESCAP



UNITEDNATIONSESCAP



UNITED-NATIONS-ESCAP

