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Leibniz Institute of Agricultural Development
in Transition Economies

IAMO

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in Transition Economies

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Foreword

Despite the ongoing pandemic, IAMO was again able to further the consolidation and institutionalisation of its research and transfer activities in Halle and its partner regions in 2021. The Institute also managed to expand its acquisition of third-party funding in strategic future-oriented fields, and once more increased its publication activity in high-quality publications. IAMO's work thus has a sound footing, which will allow it to be active in its partner regions over the coming years as well, and boost the international visibility of German research into Eurasian transition economies.

As part of the Leibniz Competition IAMO staff successfully gained funding for two big projects in 2021:

The project **RuWell – Rural well-being in transition: multidimensional drivers and effects on (im)mobility**, drawn up by an IAMO staff member, is one of five Leibniz Junior Research Groups. This research project, which runs for five years, is investigating the connections between individual wellbeing and outmigration in rural areas of Eastern Germany and Southeast Europe. One of the areas of study will be the hitherto little-studied dimension of attachment to a particular place.

TraFFF – Transnational families, farms and firms: migrant entrepreneurs in Kosovo and Serbia from the 1960s to today, coordinated by the Regensburg Leibniz-Institute for East and Southeast European Studies (IOS), is addressing the question of which strategies are developed by migrants and their families to use the resources acquired during migration for entrepreneurial activity in their old homeland.

As part of the projects approved by the German Ministry of Education and Research (BMBF) **DITAC – Digital**

transformation of China's agriculture – resources, trade and food security and ERA-FDC-Policies – Agricultural potential in Russia taking account of climate protection, climate adaptation and rural development, IAMO, together with international partners from China, Russia and other Western countries, is researching future questions of agriculture: digitalisation processes in agricultural value chains as well as adapting agriculture to climate change in our partner countries.

The Agricultural Policy Dialogue (APD), launched by the German Ministry of Food and Agriculture (BMEL) with a number of partner countries is designed to promote dialogue and networking in politics, science and business. For several years now, IAMO has been helping run the German–Ukrainian Agricultural Policy Dialogue and the Sino–German Agricultural Centre (DCZ). The Agricultural Policy Dialogue Germany – Western Balkans, which began in 2021, is likewise benefiting from IAMO's expertise.

The Institute has continued to embed itself institutionally in our Eurasian partner countries in 2021. In November, as part of the **Pilot project for the sustainable internationalization of Ukrainian research structures in the context of the globalization of the Ukrainian food sector (UaFoodTrade)**, a new research centre was founded. The Centre for Food and Land Use at the Kyiv School of Economics (KSE) will undertake international-standard analyses of agricultural and land policy, agricultural markets, agricultural exports and the relevant value chains in Ukraine, and offer scientifically based policy advice. Other activities include the signing of a **Memorandum of Understanding (MoU)** by the Uzbek Minister of Agriculture Jamshid Khodjaev and an IAMO

representative, as well as between the Ural State University (UrSEU) in Yekaterinburg and IAMO.

The rise in IAMO staff numbers over the past few years thanks to successful third-party funding and increased transfer activities in our partner countries is also reflected in an increase in publication activity. In 2020 the number of refereed publications in journals with impact factor had risen from 45 (2019) to 64; in 2021 this rose to an impressive 80 articles. IAMO's strategy of accelerating capacity building in our target regions likewise benefits the Institute's research and publication activity. It is intensive exchange with local people in the agricultural and food sector that enables grounded research, which is closely oriented to the problems of globalising agrifood chains, and the needs of rural areas in Eurasian transition economies.

After much renovation **IAMO's new library** opened on 1 June 2021. It now houses a modern **information centre**. Innovative, digital ways of accessing information and new possibilities for research required a comprehensive adaptation of the old space, a wider range of information technology as well as the creation of jobs to satisfy this demand. The library now offers new opportunities for individual research with the help of the most up-to-date IT infrastructure, as well as space for meetings, training, teamwork and collaborative working at the Institute.

Only thanks to the assistance of its highly efficient administration was IAMO able to meet the challenges of another year with severe restrictions on personal contact. By creating hygiene procedures, flexible working conditions as well as making available and continually adapting its powerful IT infrastructure, the Institute was able to continue its successful work of the

past few years under the conditions of the Coronavirus pandemic.

IAMO's success would not be possible without the wide-ranging support and valuable ideas we get from the Saxony-Anhalt Ministry of Science, Energy, Climate Protection and Environment, and from the German Ministry of Food and Agriculture (BMEL). We should therefore like to offer our particular thanks to these ministries. Important suggestions have also come from the members of the Board of Trustees and Scientific Advisory Board. We are very grateful to them too.

The first two articles in this edition look at the effects of the COVID-19 pandemic on agriculture, food and rural areas in Central Asia and the Caucasus; and on transport costs of maritime trade in agricultural goods, and the consequences for global food security. Articles three and four focus on Southeast Europe. They examine the effects of migration and remittances on rural households in Kosovo, and the historic roots of marked regional diversity in former Yugoslavia. China is the focus of articles five and six, with an analysis of the evolution of crayfish-rice integrated farming systems and a look at the effects of contract farming on environmentally sustainable rice production. The seventh article examines aspects of the adoption of sustainable agricultural technologies and strategies in Kazakhstan and Uzbekistan. The reasons for social engagement by farmers in emerging nations is the subject of the eighth article, while the ninth focuses on the mobilisation of informal knowledge networks for the sustainable diffusion of agriculture-related information in a social-network analysis. The final article is a report on the IAMO Forum 2021 on the topic "Agrifood Systems in the Bioeconomy".

Nodir Djanibekov and Thomas Herzfeld

2020 – The first year of the COVID-19 pandemic in Central Asia and the Caucasus: government responses and the consequences for agriculture and rural areas



2020 – The first year of the COVID-19 pandemic in Central Asia and the Caucasus: government responses and the consequences for agriculture and rural areas

Nodir Djanibekov and Thomas Herzfeld

COVID-19 in context

This study highlights various aspects of the performance of the agricultural and food economies of the Central Asian and Caucasus countries (CAC) over the course of 2020 with particular reference to the consequences of COVID-19. After a brief survey comparing the spread of Coronavirus in the eight countries as well as the political measures taken to combat the virus, the focus is on the consequences for agriculture, food chains and rural households. Our analysis is based on a variety of sources, from available secondary data from offices of national statistics to reports by advisers. The quantitative data have been supplemented by qualitative information from legislative texts in individual countries, by national and international reports as well as other publicly available sources including the mass media. The economic effects in the CAC countries can only be approximated, however. Identifying the impact of individual pandemic measures or political interventions is virtually impossible.

The eight CAC countries are different economically. This is highly significant when understanding the variable effects of the COVID-19 pandemic (**Table 1**) In most of these countries agriculture accounts for a considera-

ble share of gross domestic product (GDP). Agriculture also employs a large proportion of the region's population. In Tajikistan, the country at the top of this list, almost half of the working population is employed in agriculture. Although the figure varies substantially from country to country, in none of them does the share of the working population in agriculture fall below 14.9 per cent. With the exception of Kyrgyzstan and Uzbekistan, however, agriculture's share in GDP is only half of the sectoral share in the working population, or even lower. This demonstrates the comparatively low labour productivity of agriculture compared to non-agricultural activities. Remittances, mainly from labour migrants in Russia, make a significant contribution to national income, especially in those countries of the region that do not export raw materials. For this reason Tajikistan and Kyrgyzstan, countries poor in raw materials, are hotspots of global labour migration. Oil and gas exports make up almost 25 per cent of the GDP of countries like Azerbaijan, Turkmenistan and Kazakhstan, which are rich in raw materials. The economic situation in these countries is thus highly dependent on the price developments on international energy markets or the demand for their nat-

ural resources. Moreover, international tourism in Central Asia and the Caucasus has grown. For many economies in the region tourism is a strategy for diversifying income

sources. Finally, the CAC countries are dependent on food imports, which comprise a considerable share of their imports overall.

Table 1: Selected economic indicators of the countries of Central Asia and the Caucasus

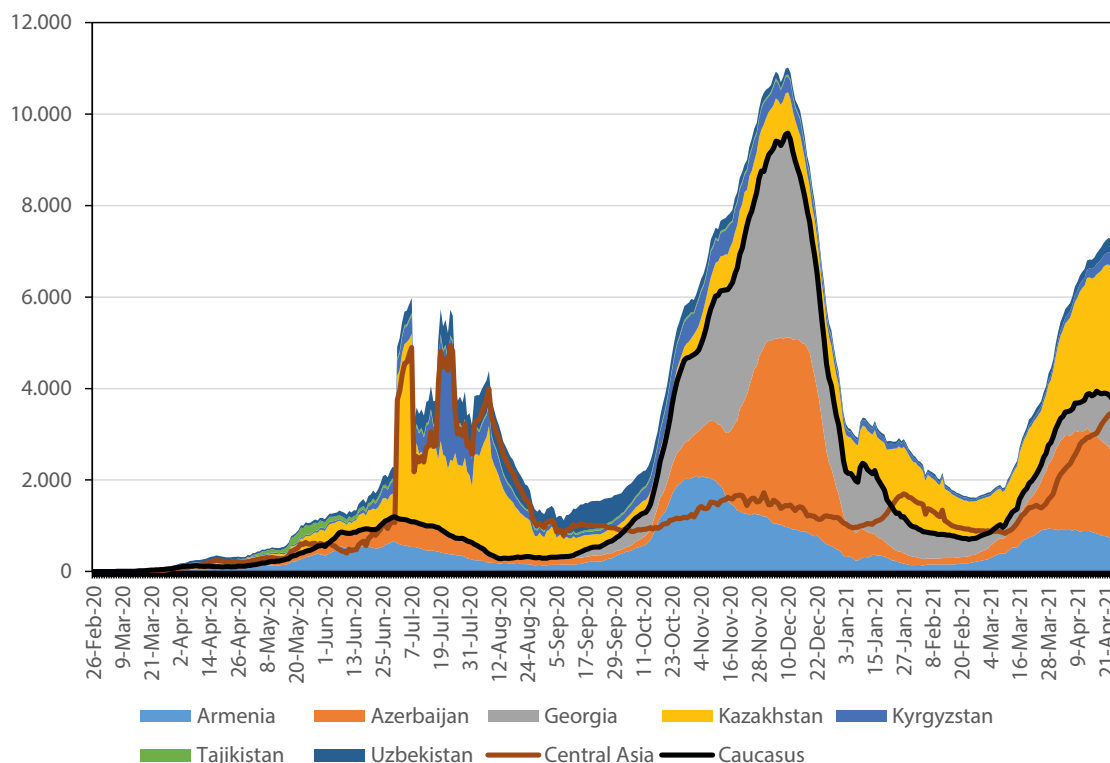
Country	Agriculture (per cent of GDP) ^a	Employment in agriculture (per cent of working population) ^b	Remittances (per cent of GDP) ^c	Income from international tourism (per cent of GDP) ^d	Food imports (per cent of all goods imported) ^d	Total raw material revenue (per cent of GDP) ^a
Armenia	12,0	24,0	11,2	11,4	16,5	2,1
Azerbaijan	5,7	36,0	2,7	4,2	13,8	25,5
Georgia	6,5	38,2	12,9	20,3	12,7	0,1
Kazakhstan	4,5	14,9	0,3	1,6	9,9	17,6
Kyrgyzstan	12,1	19,3	28,5	8,4	13,3	0,6
Tajikistan	19,2	44,7	28,6	2,2	n.a.	2,8
Turkmenistan	9,3	20,7	<0,005	n.a.	n.a.	24,1
Uzbekistan	25,5	25,7	14,8	2,9	9,3	8,8

Notes: a – all countries in 2019, Tajikistan 2018, Turkmenistan 2015; b – all countries in 2019 (modelled ILO estimate); c – all countries in 2019, Turkmenistan 2018; d – all countries in 2019.

After reaching the CAC countries, COVID-19 spread in several waves. The region experienced two major waves in 2020 (**Figure 1**). On 26 February 2020 Georgia reported its first confirmed COVID-19 case, whereas Armenia and Azerbaijan noted their first cases on 1 March 2020. By mid-March the pandemic had also reached the countries of Central Asia, with the first cases in Kazakhstan on 13 March, in Uzbekistan on 15 March, and in Kyrgyzstan on 18 March. The first case officially declared by the authorities in Tajikistan followed on 30 April. Turkmenistan is the only country in the CAC region without an officially confirmed case.

Later, Coronavirus spread potently across Central Asia during the summer, whereas the Caucasus countries were more affected in autumn 2020. The daily number of new cases increased rapidly in June 2020, putting the health system in July and August of that year under severe pressure. In the Caucasus region the first wave was only serious in Armenia. Azerbaijan and Georgia managed to bring the first wave quickly under control with strict containment measures. The second wave in the Caucasus escalated from September with an exponential growth of confirmed new cases and deaths. By the end of 2020 the CAC countries had reported just under one

Figure 1: Seven-day moving average of newly reported COVID-19 cases in Central Asia and the Caucasus (March 2020 to April 2021)



Note: The officially reported COVID-19 cases may have been influenced over time by an improvement in testing, reporting criteria and administrative capacity (especially in rural areas), as well as differences between countries in reporting guidelines. Turkmenistan has officially been declared a COVID-free country.

8

million confirmed COVID-19 cases and 13,000 deaths linked to the virus. Two thirds of these cases were from the Caucasus countries.

In the individual countries of the region the COVID-19 pandemic produced different political responses and measures for avoiding the spread of the virus, as well as for mitigating the socio-economic consequences. The

measures across the region varied considerably in their stringency, speed of implementation as well as in regard to the (non-)lifting of these measures. Whereas all countries imposed at least some very similar measures to reduce personal contact and mobility, the policies for boosting economic recovery were more heterogeneous.

Many countries immediately implemented policies to prevent COVID-19 deaths as well as to avoid overburdening hospitals and essential health institutions. Almost all the countries imposed a complete lockdown for several weeks in spring 2020. The governments of Tajikistan and Turkmenistan imposed the least stringent regulations, whereas all the other countries introduced the strictest possible measures at the beginning of the pandemic in March 2020. In the third quarter of 2020 Kyrgyzstan, Tajikistan and Uzbekistan began to ease their containment measures despite ongoing high infection rates, because strict lockdowns were adjudged to be economically unsustainable. By contrast, stringent containment measures remained in place in the Caucasus countries, where further outbreaks occurred in autumn 2020, until early 2021.

Agricultural and food policy measures during the COVID-19 pandemic

The CAC governments implemented measures to mitigate the economic impact of interruptions to supply chains in the agricultural and food economy. The type and extent of these measures differed from country to country, depending on the degree of political intervention and financial resources. In the agricultural sector the COVID-19 pandemic brought about totally new policy measures, although in some countries the level of intervention was lower.

Overall most countries introduced tax and subsidy incentives, such as lowering taxes for certain agricultural activities and processing stages, as well as deferring, reducing or even cancelling credit repayments and interest rates. Several governments also supplemented existing

support programmes for the agricultural sector with further relief on subsidised credit, which in 2020, for example, had its interest rate set at zero. For farmers this represents a complete subsidisation of interest on agricultural loans. After COVID-19 hit most countries in spring – when work in the fields begins in agriculture – governments financed the spring sowing. In all cases producers were given access to affordable sources of financing, whereas banks in the first phase of national lockdowns had to offer a temporary suspension of credit repayments.

By reducing financial burdens induced by the pandemic the governments set targeted production incentives for enterprises and households, especially in small-scale agriculture. Policy measures to support businesses in processing and trade allowed for an interest-only period of between three and six months for credit to small and medium-sized businesses. There were also tax respite or temporary relief from tax and insurance premium payments for processing firms in the food economy.

To secure sufficient supply and to counter price rises the CAC countries imposed export restrictions, lowered import tariffs or removed them altogether. Kazakhstan, Kyrgyzstan and Tajikistan restricted exports for a range of basic foodstuffs by either prohibiting their export or setting quotas. For example, on 22 March Kazakhstan imposed an export ban on important basic foodstuffs. A few weeks later, in April, this was replaced by an export quota that was in place until June 2020. On 31 March the countries of the Eurasian Economic Union (EAEU) introduced a three-month export embargo for basic foodstuffs to countries outside the EAEU. To avoid food shortages and to stabilise food prices, most countries also temporarily set their import tariffs to zero and implemented import subsidy programmes for important

basic foodstuffs. The EAEU countries expanded the list of critical foods exempted from import tariffs for the period April to June 2020. To slow down price rises, basic foodstuffs were exempted from value added tax (VAT). A further intervention in the food markets and pricing was the government purchase of key agricultural goods to raise the public food reserves, which were then sold at reduced cost to stabilise domestic prices.

The policy measures to protect the food supply varied from country to country, but normally included food aid, single support payments to vulnerable groups and food price controls. Several countries also introduced support payments for the unemployed, self-employed or those who had been dismissed without payment. In Kazakhstan, Kyrgyzstan and Tajikistan the governments set upper price limits for basic foodstuffs, whereas the governments in other countries monitored the prices but did not intervene directly to regulate them. The greatest challenge for governments was that in some cases vulnerable groups were not targeted quickly enough or even not at all. These included, in particular, returning migrants or families dependent on remittances. In most of the countries, families at risk were provided with food aid. There were scarcely any measures tailored specifically to returning migrants, however. In Georgia the government expanded the 2015 programme for supporting the reintegration of returning Georgian migrants (Mamardashvili et al., 2021). In Uzbekistan the government made state-owned land available for redistribution as short-term leases of one-hectare parcels to young farmers, who comprise the majority of potential migrants (Asfaw et al., 2021).

Impact of the COVID-19 pandemic on the economy as a whole

The economic effects of the global pandemic are highly complex and concern both the supply and demand side, input markets and supply chains, as well as domestic and international finance and trade relations. By evaluating selected performance indicators we will now show that in many cases only overall effects can be briefly identified rather than specific individual effects. Weather conditions also influence the prices of agricultural and non-agricultural raw materials. Exchange rate fluctuations and violent conflicts in the region have in addition impacted the development of the economy overall, as well as that of agriculture and rural areas.

From 2017 to 2019 the economy in countries of the CAC region saw a positive development with high growth rates of between 4 and 7 per cent (average from 2017 to 2019). The only exception here was Azerbaijan with an average growth rate of 1.2 per cent. Available data on the quarterly growth of GDP in 2020 show that the strict measures of March and April 2020 to stop the spread of the virus, which several countries had to impose again later, led to the stagnation of various economic activities (**Figure 2**).

In the second quarter of 2020 GDP experienced a major slump compared to 2018 and 2019. In Georgia, for example, GDP fell by almost 25 per cent in the second quarter compared to the same period in 2019. During the third quarter of 2020 – after the relaxation of restrictions in May or June – the quarterly GDP of most economies continued to shrink, but by slightly less. During the second wave of the COVID-19 pandemic in the region in the fourth quarter of 2020, the governments re-intro-

duced lockdown measures. The economic contraction that resulted was exacerbated by the military conflict between Armenia and Azerbaijan. As a consequence the GDP growth rates dropped again in the fourth quarter. Only Uzbekistan reported positive growth in GDP during the last few months of 2020.

Impact on the agricultural and food economy

The official statistical data on gross agricultural production (GAP) suggest that agricultural production was resilient in the face of the pandemic in all CAC countries except for Armenia (**Figure 3**). The increase in agricultural production value in 2020 was achieved by maintaining

the sown areas and livestock numbers at the same levels or even expanding them, and by a rise in production volumes. Kazakhstan and Tajikistan achieved the biggest increases compared to 2019. As a whole the weather conditions were favourable for agriculture in the countries concerned, with the exception of Azerbaijan. But even Azerbaijan achieved an increase in GAP compared to 2019, despite a drought (Valiyev, 2021).

In Armenia the total sown area in 2020 was smaller than in 2019. Thus the decline in the agricultural sector, which had been ongoing since 2016, continued. Livestock numbers increased in all countries in 2020. In Azerbaijan, Georgia, Tajikistan and Uzbekistan poultry production was expanded through large, new

Figure 2: Percentage changes in GDP per quarter in 2020 compared to 2018 and 2019

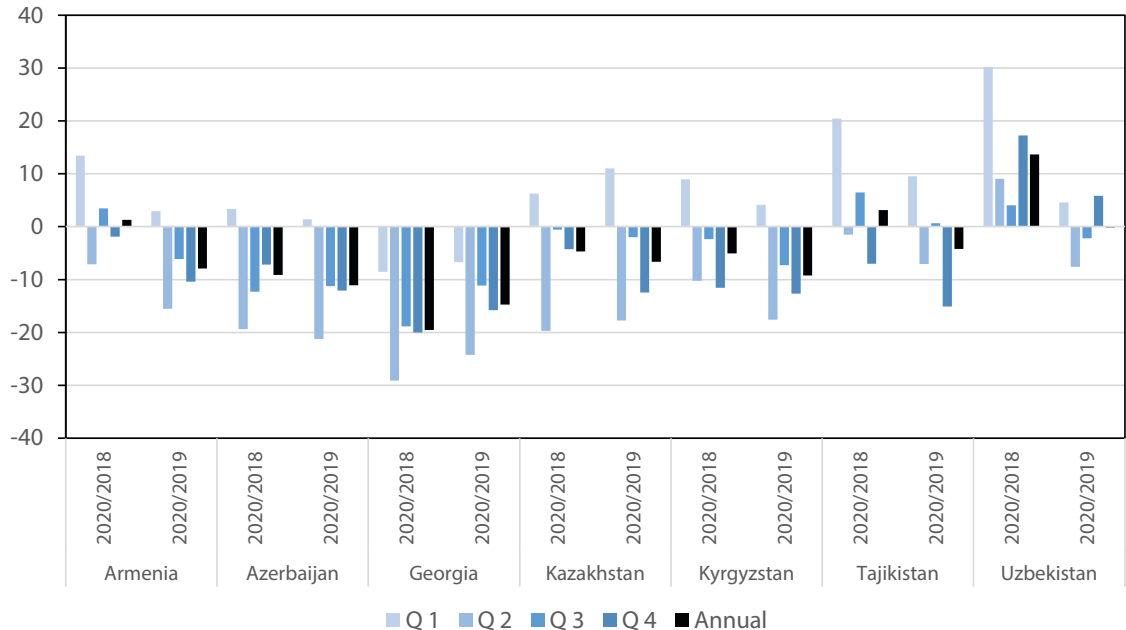
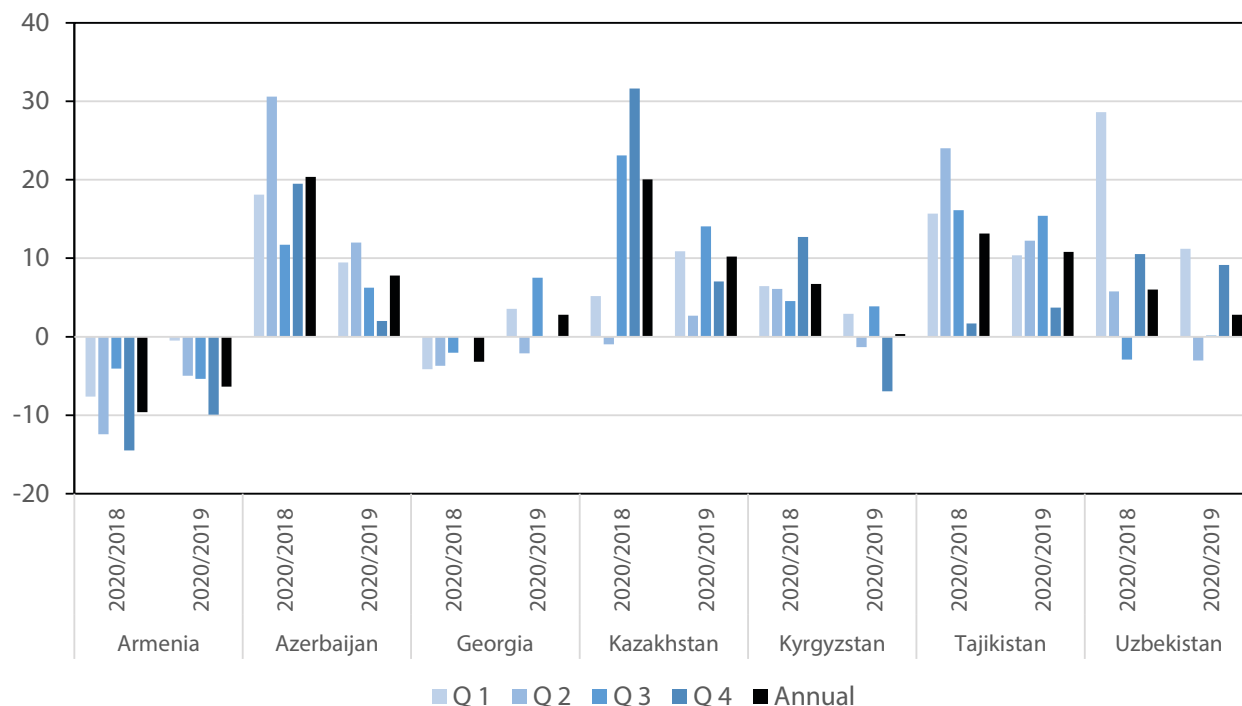


Figure 3: Percentage changes in GAP per quarter in 2020 compared to 2018 and 2019



poultry-breeding businesses. Only Kazakhstan recorded a decline in poultry numbers as a result of an outbreak of the highly pathogenic bird flu in the northern region, as well as the elimination of subsidies for egg production (Oshakbayev, 2021).

The volume of plant production rose in all countries in 2020 (**Table 2**). In Armenia grain production in 2020 was 80 per cent higher than in 2019. This massive increase can be explained in terms of a recovery, after grain production was affected by a drought and hail damage

in 2019. Wheat production in Azerbaijan in 2020, on the other hand, was 14 lower than in 2019 – essentially down to a shortage of water, but partly down to measures implemented to contain the COVID-19 pandemic. Because of ongoing agricultural reforms, wheat production in Uzbekistan was also around 1 per cent lower than in 2019. Potato production, however, rose in all countries apart from Kyrgyzstan, where farmers had reduced the total sown area because of the expectation of low prices (Tilekeyev, 2021). In most countries fruit, vegetable and mel-

on production increased. Armenia, whose government is trying to increase wine production and exports, saw a considerable expansion of grape production.

Overall the volumes of animal production grew in 2020, continuing a trend in the region over the past decade (**Table 3**). Animal production was up 3 to 5 per cent on 2019. These increases suggest that animal production has been robust in spite of the pandemic and higher feed prices. In this regard, egg production in Tajikistan shows a striking deviation from the general trend. Thanks to the current state programme to develop the sector by supporting large private poultry-breeding firms, the country increased both the number of hens as well as their productivity (Khakimov, 2021). Egg production in Tajikistan has thus increased considerably.

Domestic trade and food prices

During the COVID-19 pandemic a number of restrictions and prohibitions were placed on retail, which had a negative impact on domestic trade (**Figure 4**). Despite the fact that the first two months of 2020 recorded higher levels of domestic trade than in 2019, domestic trade was lower in 2020 overall than in 2019. Given the devaluation of national currencies as well as the increase in consumer prices it must be assumed that the reported downturn was even more pronounced than depicted in Figure 4. There are indications that during the strict lockdown and closure of the catering sector, it was difficult for farmers to find sufficient alternative marketing channels. Some were faced with such restrictions that they found it simply impossible to sell their goods. Moreover, the interruptions for those farmers and processors producing perishable goods for supply chains oriented to

the catering sector, such as milk, meat and fruit, lasted longer than for farmers and processors producing traditional products. In Armenia the Bergkarabach conflict in October 2020 also had a negative impact on domestic trade (Tadevosyan, 2021).

The lockdown measures, orders to stay at home, home schooling, work from home, the closure of shops and markets as well as loss of income all influenced people's consumer behaviour. In addition there were substantial price fluctuations in the CAC countries in 2020 – partly corresponding to the depreciation of currencies. In March and April 2020 interruptions in supply chains caused by the COVID-19 pandemic (**Figure 5**) led to food shortages and further increases in food prices. By comparison with 2019, food price peaks in this period are a result of a short-term increase in demand for food induced by fears over shortages, and also of hoarding of food. As 2020 went on, the consumer price index (CPI) stabilised in relation to 2019 from May, due to the new harvest and the satiation of consumer demand for food. The lifting or relaxation of strict lockdown measures also helped reduce the monthly food price inflation from May to September 2020. In some countries the monthly food price indices remained stable by comparison to 2019, whereas in Uzbekistan the prices rose again from September.

Four studies from Armenia, Kyrgyzstan, Tajikistan and Uzbekistan, based on household surveys allow us to better understand the effects of the pandemic on food security. The findings from these four micro-studies suggest that the COVID-19 pandemic had a negative impact on employment, remittances, income and food security. Household surveys carried out several times over the course of 2020 in Tajikistan and Uzbekistan also show

Table 2: Plant production (in 1,000 t) in 2019 and 2020, and changes between 2020 and 2019 in per cent

	Armenia			Azerbaijan			Georgia		
	2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019
All grains	198,3	358,1	80,6	3.538,5	2.935,2	-17,0	364,2	405,1	11,2
Wheat	112,6	132,0	17,2	2.171,5	1.867,3	-14,0	100,6	102,4	1,8
Rice	n.a.	n.a.	n.a.	12,0	9,8	-18,3	n.a.	n.a.	n.a.
Other grains	85,6	226,2	164,1	3.538,5	3.257,1	-8,0	263,6	302,7	14,8
Cash Crops	n.a.	n.a.	n.a.	301,3	343,4	14,0	2,6	1,9	-26,9
Cotton	n.a.	n.a.	n.a.	295,3	336,5	14,0	n.a.	n.a.	n.a.
Legums	3,2	4,1	27,3	36,0	21,7	-39,7	5,9	5,2	-11,9
Potatoes	404,1	437,2	8,2	1.004,2	1.037,6	3,3	194,7	208,6	7,1
Vegetables	621,6	692,8	11,5	1.714,7	1.738,9	1,4	161,1	176,1	9,3
Melons	128,0	126,6	-1,1	447,6	448,1	0,1	79,9	83,6	4,6
Fruits and berries	290,6	274,3	-5,6	1.099,7	1.133,1	3,0	144,4	228,6	58,3
Grapes	217,5	283,2	30,2	201,8	208,0	3,1	293,8	316,9	7,9

Table 3: Production of animal products (in 1,000 t for meat and milk; in millions of eggs) in 2019 and 2020, and changes between 2020 and 2019 in per cent

	Armenia			Azerbaijan			Georgia		
	2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019
All meat	107,3	107,7	0,4	573,3	591,1	3,1	69,5	69,4	-0,1
Milk	667,9	654,3	-2,0	2.150,8	2.192,5	1,9	544,9	551,9	1,3
Eggs	720,6	754,6	4,7	1.827,1	1.906,2	4,3	661,2	674,5	2,0

Kazakhstan			Kyrgyzstan			Tajikistan			Uzbekistan		
2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019
17.232,2	19.883,3	15,4	1.781,0	1.856,0	4,2	1.414,6	1.561,4	10,4	6.109,3	6.366,8	4,2
11.451,6	14.258,0	24,5	601,2	629,1	4,6	836,9	864,2	3,3	6.093,5	6.016,3	-1,3
560,7	556,8	-0,7	41,2	44,5	8,0	106,4	133,4	25,4	314,7	284,9	-9,5
5.219,9	5.068,5	-2,9	1.138,6	1.182,4	3,8	471,3	563,7	19,6	n.a.	n.a.	n.a.
486,7	467,5	-3,9	853,0	546,0	-36,0	450,1	442,6	-1,7	n.a.	n.a.	n.a.
344,4	326,6	-5,2	80,0	73,0	-8,8	403,0	396,0	-1,7	2.691,7	2.236,0	-16,9
196,4	180,0	-8,4	109,0	107,0	-1,8	78,3	90,3	15,4	339,6	330,9	-2,6
3.912,1	4.006,8	2,4	1.374,0	1.327,0	-3,4	994,4	1.022,5	2,8	3.089,7	3.143,5	1,7
4.355,2	4.590,9	5,4	1.134,0	1.131,0	-0,3	2.182,6	2.479,4	13,6	10.215,1	10.459,5	2,4
2.382,1	2.425,1	1,8	246,0	262,0	6,5	701,2	757,0	8,0	2.068,7	2.134,4	3,2
301,0	347,3	15,4	270,0	278,0	3,0	473,8	470,4	-0,7	2.752,7	2.864,0	4,0
90,4	95,1	5,2	9,0	9,4	4,4	247,2	240,0	-2,9	1.603,3	1.639,2	2,2

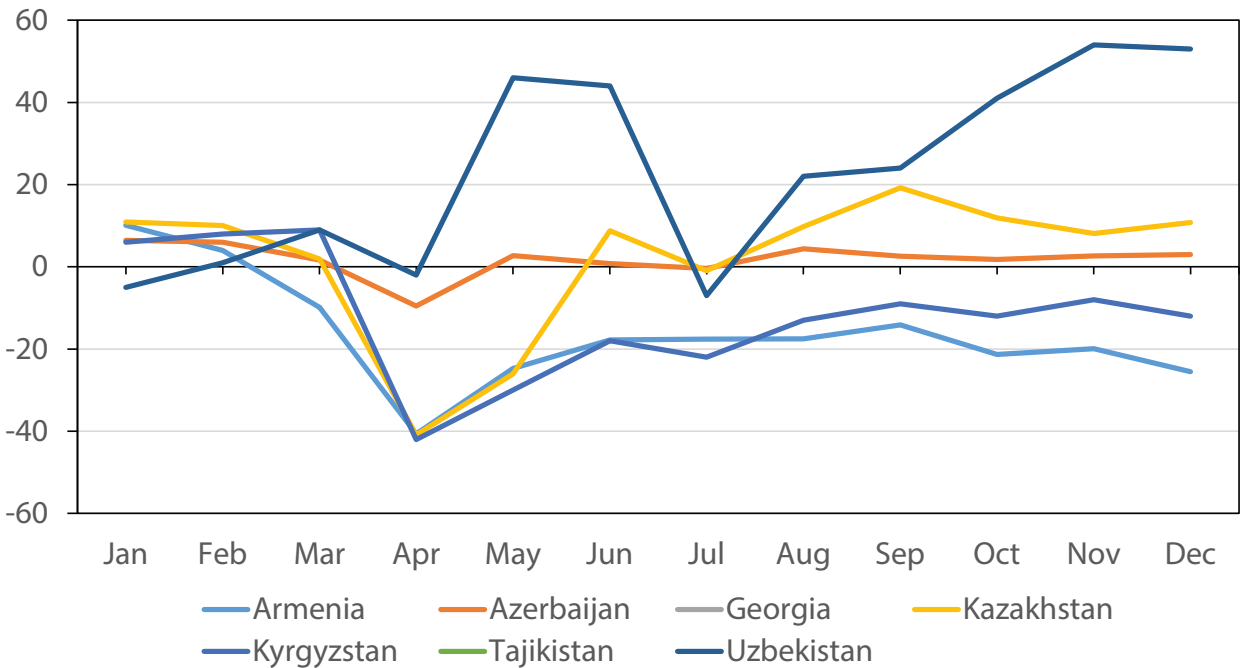
Kazakhstan			Kyrgyzstan			Tajikistan			Uzbekistan		
2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019	2019	2020	2020/2019
1.120,6	1.168,6	4,3	226,2	230,4	1,9	272,5	300,2	10,2	2.473,6	2.526,2	2,1
5.864,9	6.051,4	3,2	1.627,8	1.668,0	2,5	1.000,6	1.021,0	2,0	10.714,3	11.009,9	2,8
5.531,4	5.065,8	-8,4	561,3	562,0	0,1	725,7	983,1	35,5	7.771,2	7.825,0	0,7

that the severe disruptions caused by the COVID-19 pandemic were only temporary and that households recovered after the relaxation of restrictive measures to contain the Coronavirus.

The World Food Programme (WFP) carried out a food security and vulnerability assessment in Armenia in June and July 2020 to obtain new data to evaluate the effects of the pandemic on food security in the country, and to identify the population groups most in need of protection. The study came to the conclusion that by disrupting daily life and activities COVID-19 had a major impact on household income as well as access to food and other resources (WFP 2021). More than 41 per

cent of those households surveyed reported difficulties accessing food shops and markets because of financial circumstances and restrictions due to the COVID-19 pandemic. The income of 58 per cent of households in the study was negatively affected by the pandemic. 45 per cent of households surveyed experienced temporary interruptions in work, 20 per cent saw jobs lost for good and 35 per cent were only able to attain a lower salary or income. Households' food and eating habits were affected by the pandemic too, as people ate more processed food and fewer wholefoods. The nutritional standards of large groups of those surveyed was below the acceptable threshold. Only 11 per cent of households taking

Figure 4: Monthly retail index, percentage change year on year



Note: There are no retail data for Georgia.

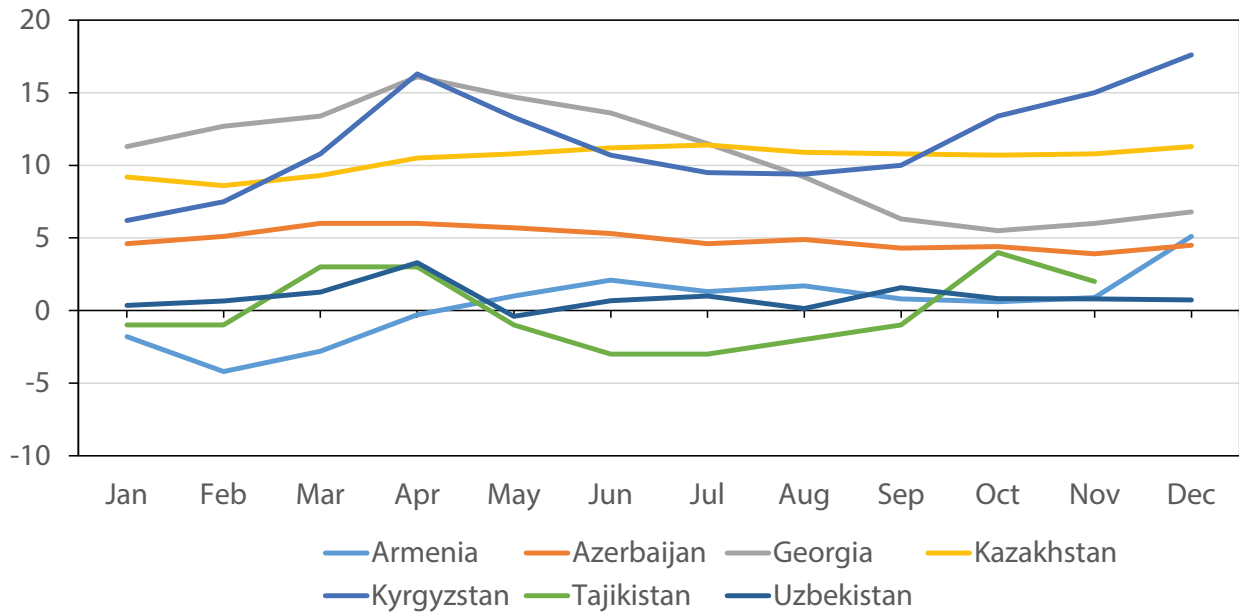
part in the study were able to maintain the same access to foodstuffs during the COVID-19 pandemic as before, whereas 58 per cent of households had to resort to crisis or emergency strategies to secure access to food.

A study by the National Statistical Committee in Kyrgyzstan on the effects of the COVID-19 pandemic on households has shown that almost all those surveyed faced a reduction in their income as well as spending of between 9 and 14 per cent. The study also attests to a reduction in living standards through a fall in income, loss of jobs, obstacles to accessing basic services and a lower consumption of food (National Statistical Committee of the Kyrgyz Republic, 2021). Around 22 per cent of

households surveyed reported temporary or permanent job losses affecting at least one household member. 54 per cent of households faced reductions in income. The effects on the availability of food were severe: 46 per cent of households reported difficulties in buying food. Almost three quarters of households experienced financial problems and 44 per cent of households reduced their expenditure on food. The proportion of spending on food rose from 42 per cent in 2019 to 46 per cent in 2020. This suggests a worsening of food security during the COVID-19 pandemic.

The Tajik household survey “Listening to Tajikistan” (L2TJK) revealed severe disruptions in the labour mar-

Figure 5: Food price indices in 2020, percentage change year on year



ket, as well as a reduction in remittances and food consumption. The proportion of households saying that that no household member had worked over the past seven days rose from 20 per cent in March 2020 to almost 40 per cent in May (World Bank, 2020a). In addition, the proportion of those surveyed reporting a worsening of their family's financial situation rose from 8 per cent in March to almost 23 per cent in May. Income from remittances fell dramatically in April, as 61 per cent of the households in the study stated. Around 41 per cent of households surveyed reported a lower level of food consumption in April and May 2020. This was considerably higher than in the same months in 2019, for which the figure was 24 per cent. Overall a range of indicators show that food security deteriorated in April and May 2020. The proportion of those who stated they went hungry, reduced their variety of foodstuffs and were worried about obtaining sufficient food rose. After the Tajik government lifted the lockdown measures, the labour market rapidly began to recover from June, and in August employment approached the level it had been in 2019 (World Bank, 2020b). In addition, the proportion of household members affected by disruption to their work caused by the COVID-19 pandemic fell in May from 63 per cent to around 40 per cent. The proportion of households reporting a fall in remittances also fell from 61 per cent in April to 25 per cent in August. Less than 2 per cent of those surveyed still mentioned local shortages of basic goods in August. This figure is substantially down from 10 per cent in May. The proportion of households reporting lower levels of food consumption also fell from 41 per cent in May to 29 per cent in August, although this figure was still more than 10 percentage points higher than in August 2019.

The Uzbek survey "Listening to the Citizens of Uzbekistan" (LC2U) revealed dramatic reductions in employment, well-being and income because of the outbreak of COVID-19 (World Bank, 2020c). In April 2020 the proportion of households surveyed with at least one working member fell dramatically to 42 per cent from 85 per cent in March 2020. Job losses were highest amongst the self-employed. Here the proportion of those reporting being in work fell by 67 percentage points in April. The poverty rate increased as a result of the pandemic. According to World Bank calculations it rose after the outbreak by between 8.7 to 10 percentage points, as opposed to estimates prior to the COVID-19 pandemic of 7.4 per cent. The proportion of households reporting reduced food consumption reached a peak in April of 26 per cent. At the same time around 80 per cent of those surveyed admitted to being worried about rising prices, whereas only a quarter had a year earlier, in April 2019. The pandemic exacerbated existing differences in food security between households with a male or female head. Thus, in May 2020, around 13 per cent of households surveyed with a male head were unable to buy sufficient food, whereas the corresponding figure for households with a female head was 21 per cent. Like in Tajikistan the LC2U survey came to the conclusion that the gradual lifting of lockdown measures led to a rapid recovery of the labour market (World Bank, 2020c). As the government in Uzbekistan relaxed restrictions the proportion of households in which at least one member was working increased again from May, although the previous year's level was not reached at any point in 2020. Thus in December the figure was 6 percentage points lower than that in 2019 (World Bank, 2021). By contrast the proportion of households reporting reduced food consumption

fell from 26 per cent in April 2020 to the usual level of 20 per cent by the end of the year (World Bank, 2021).

Remittances and remigration

The COVID-19 pandemic triggered a process of remigration that had never been seen before in the CAC region. For example, in 2020 more than 500,000 Uzbek nationals (many of them labour migrants) came back on charter flights, by train or across the Kazakh border. In most countries remittances fell from March onwards below the 2019 level (**Figure 6**). Only in the third quarter of 2020 did money flows from remittances recover in Georgia, Kyrgyzstan and Uzbekistan, even surpassing the total figure for 2019 in the end.

Several factors had a negative influence on labour migration as well as remittances during the pandemic. After the Russian Federation banned entry on 18 March and the neighbouring countries also took measures to restrict international mobility, many migrants from the CAC region were no longer able to travel out of their home countries. Normally migration to the Russian Federation from Tajikistan, Kyrgyzstan and Uzbekistan reaches its seasonal peak at the end of March and beginning of April. The total shutdown of urban-based sectors in Russia with a high proportion of migrants, like simple services and construction, kept many migrants – especially men from rural areas – at home. Because of the lockdown in the Russian Federation many Uzbek seasonal labourers lost their work and returned home. The depreciation of the national currencies of the Russian Federation and Kazakhstan in May, linked to falling oil prices, was a further cause of reduced remittances.

Conclusions

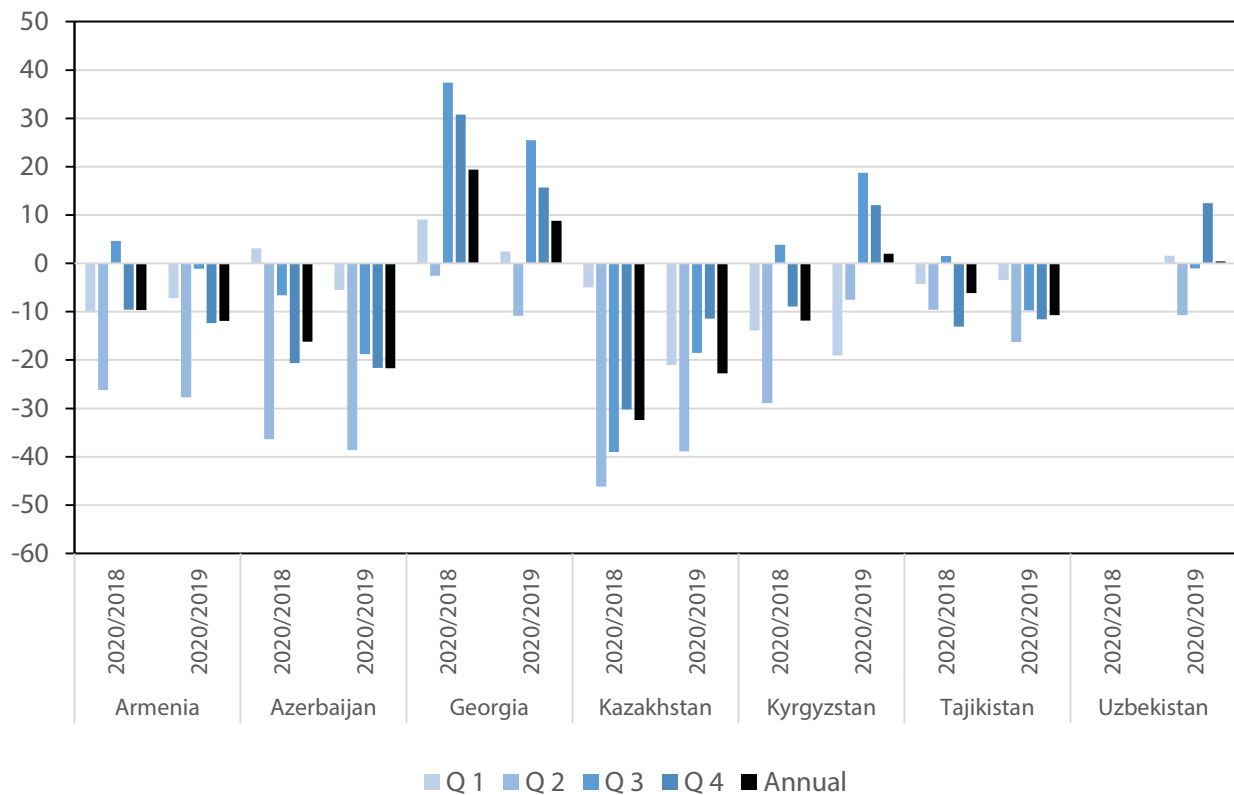
Overall the measures taken by the CAC governments varied over time and between countries from very stringent to fairly moderate. Moreover, the strict containment measures imposed in March and April 2020 brought to a halt various forms of economic activity such as the taxi trade, gastronomy and tourism. Most countries issued green passes to ensure freedom of movement for those in agricultural activities. Later, governments switched from a total to partial lockdown to ease the economic burden. Restrictions on public events and gatherings were kept in place, however.

The COVID-19 pandemic in 2020 led to the shrinking of the economies of the CAC countries and affected the most important income-generating sectors of the region, such as oil extraction, inflows from remittances and tourism. The regional recovery in the third quarter of 2020 was interrupted by the strong resurgence of the virus at the end of 2020. The economic downturn was less severe, however, than during the first outbreak of the virus in the second quarter of 2020. This reflects the resilience of industrial and agricultural production as well as a recovery in the prices of raw materials.

Despite fears of catastrophic consequences for agriculture, agricultural production in the CAC region was not harmed by the pandemic or lockdown measures. In fact, favourable weather conditions in 2020 even enabled growth in the agricultural sector.

The COVID-19 pandemic led to a sharp fall in inflows from remittances from March to May. Contrary to a projected drop in remittances for 2020, however, remittances stabilised and in some cases even recovered when the year as a whole is taken into account. What is more,

Figure 6: Percentage change in incoming remittances per quarter in 2020 in relation to the same periods in 2018 and 2019



Note: Remittances to Azerbaijan, Georgia and Kazakhstan were reported in local currencies and the figures converted into USD using the monthly exchange rates.

because of remigration due to the pandemic, additional workers were available for agriculture. This had positive effects on agricultural production in 2020.

Whereas production or the supply of agricultural goods seems to have been less affected, the COVID-19 pandemic, via demand and logistics, had an impact on

food chains. Because of the drop in demand from the catering sector as well as the closure of markets, the need for storage and refrigeration facilities rose, as farmers had to switch to other marketing channels. Food sales fell substantially as shops and food markets were closed at the peak of the COVID-19 pandemic.

Overall, consumer prices rose markedly in 2020. Because of the stringent lockdown measures at the beginning of the pandemic, food prices rose from March to May. This can be explained by a reduction in imports, supply chain difficulties, the closure of local markets as well as panic-buying and hoarding. As all the countries are net importers of food, the depreciation of their currencies in relation to the US dollar also led to a rise in food prices.

The governments responded with measures to stabilise the food supply, including price subsidies for imported foods, export restrictions and price caps – albeit with variable success. Even though without subsidies food prices in some cases would have risen even further, the government measures do not seem to have succeeded in offsetting fully the negative effects of the depreciation of local currencies and of the pandemic.

All in all we can say that a long-lasting pandemic represents a risk for the development of the CAC countries. Pandemic-induced global processes in conjunction with a fall in these countries' oil and gas exports, as well as a decrease in remittances from migrants, will mean that the predicted economic recovery of Central Asia and the Caucasus will be disrupted and the economic stability of the regional economies may be undermined.

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Diagram sources and acknowledgements

Title Smallholder farmers at extension meetings near Jalal-Abad, Kyrgyzstan © Own photograph; Collage © IAMO; COVID-19 3d illustration © CREATIVE WONDER - stock.adobe.com

Tab. 1 Selected economic indicators of the countries of Central Asia and the Caucasus © World Development Indicators (2021) - <https://databank.worldbank.org/source/world-development-indicators>

Fig. 1 Seven-day moving average of newly reported COVID-19 cases in Central Asia and the Caucasus (March 2020 to April 2021) © authors' graphic. Data: Roser et al. (2020)

Fig. 2 Percentage changes in GDP per quarter in 2020 compared to 2018 and 2019 © authors' graphic. Data: national offices of statistics

Fig. 3 Percentage changes in GAP per quarter in 2020 compared to 2018 and 2019 © authors' graphic. Data: national offices of statistics

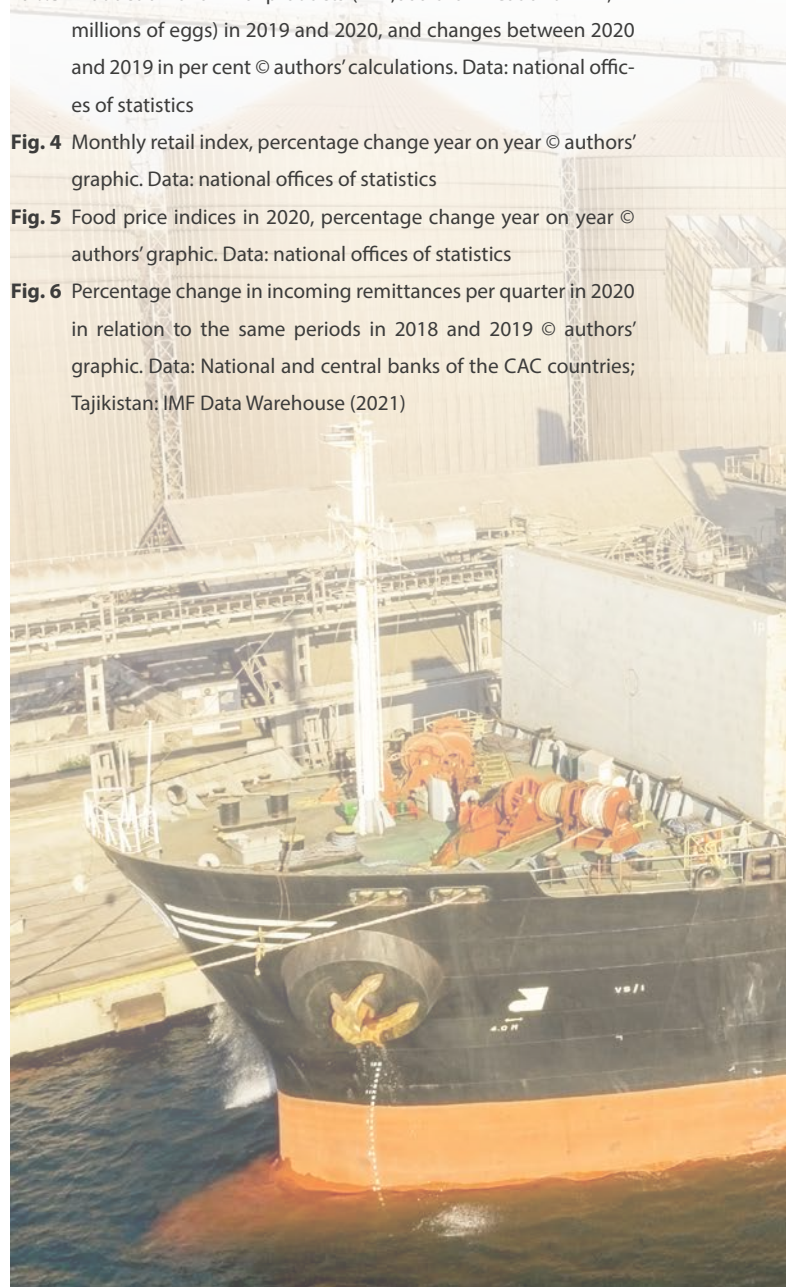
Tab. 2 Plant production (in 1,000 t) in 2019 and 2020, and changes between 2020 and 2019 in per cent © authors' calculations. Data: national offices of statistics

Tab. 3 Production of animal products (in 1,000 t for meat and milk; in millions of eggs) in 2019 and 2020, and changes between 2020 and 2019 in per cent © authors' calculations. Data: national offices of statistics

Fig. 4 Monthly retail index, percentage change year on year © authors' graphic. Data: national offices of statistics

Fig. 5 Food price indices in 2020, percentage change year on year © authors' graphic. Data: national offices of statistics

Fig. 6 Percentage change in incoming remittances per quarter in 2020 in relation to the same periods in 2018 and 2019 © authors' graphic. Data: National and central banks of the CAC countries; Tajikistan: IMF Data Warehouse (2021)



A large cargo ship with a black hull and orange bottom is shown from an aerial perspective. The ship's deck is filled with large, rectangular grain hoppers. Several yellow cranes are mounted on the ship, and one is in the process of unloading a large, yellow, conical pile of grain from a silo. The ship is moving through the water, leaving a white wake. In the background, a large industrial facility with several large, cylindrical silos and a complex network of pipes and walkways is visible under a clear blue sky.

Maximilian Heigermoser

and Thomas Glauben

**COVID-19,
growing global food insecurity
and maritime trade in agricultural goods**

COVID-19, growing global food insecurity and maritime trade in agricultural goods¹

Maximilian Heigermoser and Thomas Glauben

Since early 2020, the COVID-19 pandemic and the containment measures put in place to combat it have presented the global economy with huge, hitherto unknown challenges. To begin with, global agricultural trade did not exhibit any major shifts in relation to preceding years. New studies, however, highlight a decline in agricultural trade, specifically in the trade of meat and fish products in 2020. As a result of the pandemic the World Bank is expecting the first rise in global poverty for more than twenty years, something that can be seen in almost every country. Since mid-2020, moreover, there have been sharp increases in transport and food prices. Maritime freight prices for bulk carriers, for example, continue to be at a historically high level. Although transport costs play a significant role especially in the international trade of agricultural goods, their current impact on trade streams and the pricing of agricultural raw materials has hardly been studied to date.

In parallel, we are seeing a continual rise in the global food price index of the Food and Agriculture Organization of the United Nations (FAO). In real terms, this is now moving to a level last seen in the 1970s. It is thus expected that the risk of inadequate food supplies, especially in poorer regions, may increase again. Only greater international cooperation and free trade can guarantee food security during the prolonged phase of economic recovery, which is not uniform around the world. Calls for national self-sufficiency, or even a change of agricultural system to something excessively bureaucratic and approaching a planned economy, as well as worsening trade sanction spirals, are from a global perspective endangering food security, specifically in those politically sensitive regions dependent on imports such as North Africa and the Middle East.

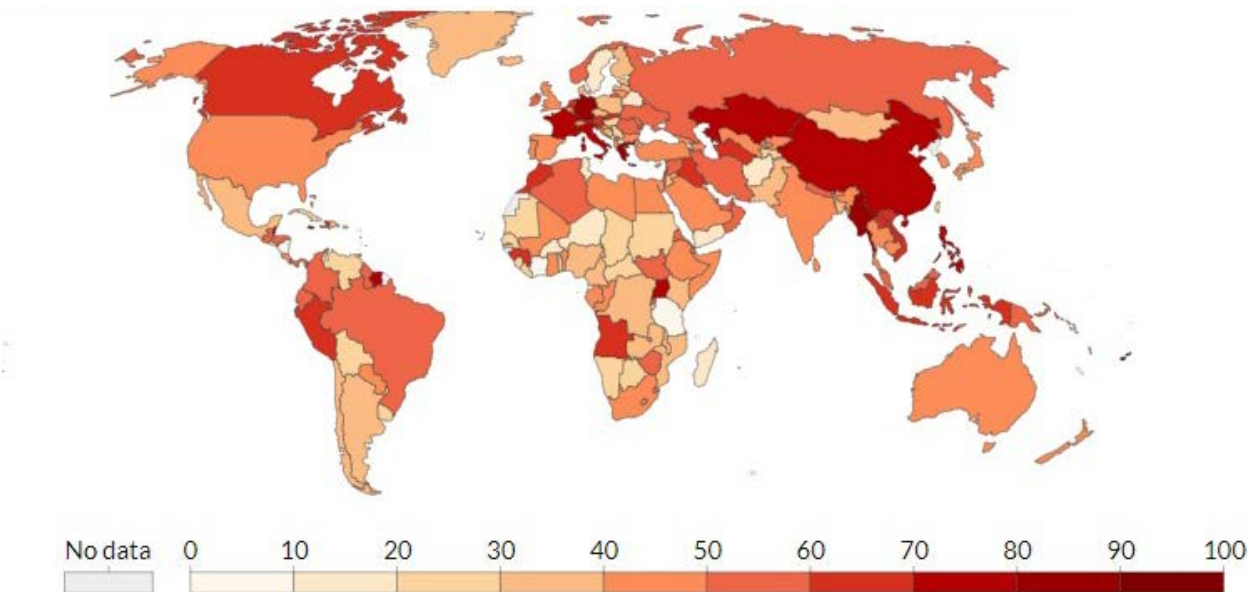
1 As of 22 December 2021. This article is largely based on the IAMO Policy Brief No. 40, which appeared in May 2021. The text has been edited for this IAMO Annual, and figures and graphics updated.

The great shock

The global spread of the SARS-CoV-2 pathogen and the measures implemented to contain it have had an impact on the global economy and global trade since the first quarter of 2020. Major slumps on financial and energy markets were seen in the second quarter of 2020 (Heigermoser & Glauben, 2020). The shutting down of entire sectors of the economy such as tourism, which is crucial for many poorer countries, led to large leaps in unemployment or short-term work, as well as declines in national economic output.

The severity and scope of measures to contain the virus, however, are very variable across the world. Countries with the strictest restrictions (as of 21 December 2021) include – besides Germany – China, Kazakhstan, Peru, France and Italy. By contrast, the measures in place in Sweden, the USA, Russia, Ukraine, Britain, Finland, Australia and Spain are comparatively less restrictive (Figure 1).

Figure 1: COVID-19 Stringency index, 21 December 2021



Note: The index depicts the strictness of COVID containment measures. The closer the index is to the maximum figure of 100, the more restrictive the measure on the reference date.

In the first half of 2020 the quantitative volume of world agricultural trade was to a large degree initially unaffected by restrictions and national lockdowns. Export restrictions imposed promptly in April 2020, to which the international community was immediately and firmly opposed, proved short-lived and did not have a far-reaching effect (OECD, 2020). A new study, however, shows that global agricultural trade did decline by between about 5 and 10 per cent in 2020, although non-food goods such as skins, furs, cotton and rubber saw greater falls (Arita, et al., 2022).

In an earlier study focusing on food imports by the countries of sub-Saharan Africa, the FAO detected reduced imports of dairy, meat and fish products in 2020 (Schmidhuber & Qiao, 2020). Particularly in countries where the population spends a large proportion of its disposable income on food, this suggests a deterioration in food quality and in the food supply overall (Laborde et al., 2020; Cui et al., 2021). The World Bank estimates that in 2020 there was a COVID-induced increase in the number of people living in poverty worldwide of around 97 million. Although the World Bank has predicted a fall in global poverty for 2021, the figure will still be 98 million people above the 2021 level originally projected in pre-COVID conditions (Mahler et al., 2021). This COVID shock thus represents the first rise in global poverty since the Asian financial crisis which led to 65 million people falling below the poverty threshold at the end of the 1990s.

Imbalances in maritime trade

As a result of the substantial isolation of national economies and increase in home working in Europe and the US, from the fourth quarter of 2020 there was a great increase in demand for durable consumer goods and leisure goods such as consumer electronics and toys. As these goods are often manufactured in Southeast Asia, this demand shock had an impact on the corresponding prices for freight containers (Reuters, 2021). The Freightos FBX Container Price Index, for example, continues to be marked up around seven times higher than before 2020. Normalisation is not expected until 2023 at the earliest. In spite of a great shortage, directional price differences also mean that some freight containers are returning empty from the US to Southeast Asia to profit from the increased rates when going in the other direction (UNCTAD, 2021).

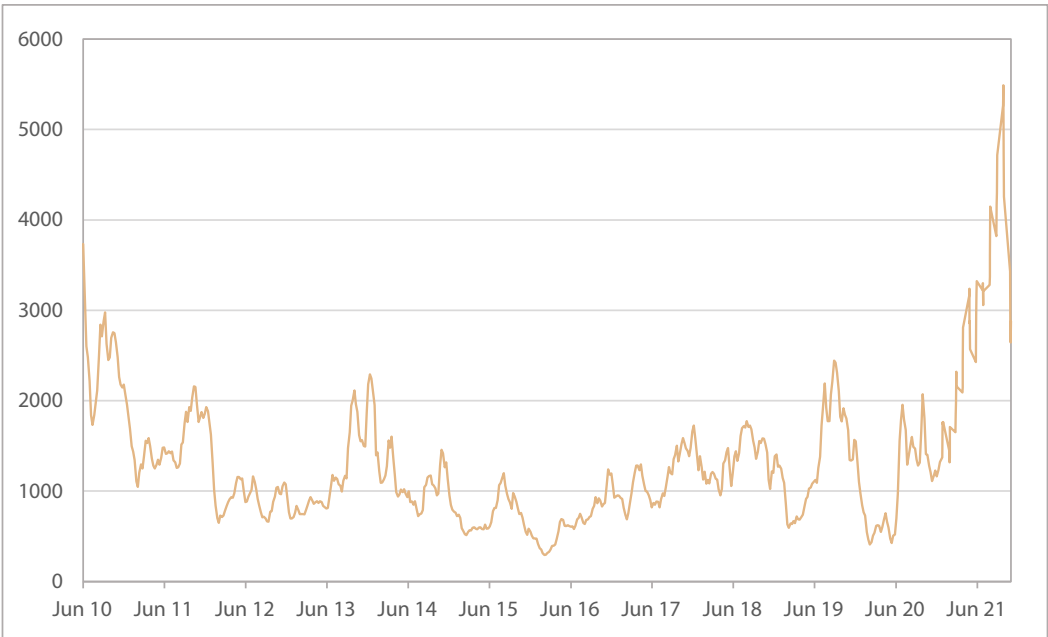
International maritime trade in agricultural raw materials is largely processed by bulk carriers rather than containers. The Baltic Dry Index (BDI),² an index for freight prices of these raw material transport ships, reached a maximum at the beginning of October 2021. At that time it was at a thirteen-year high, at around 290 per cent of the previous year's level (**Figure 2**). This could partly be explained by higher crude oil and thus fuel prices, as well as an increased demand for construction materials and industrial raw materials such as steel and coal. Although the BDI fell sharply in the fourth quarter of 2021, it is still

2 The BDI is an indicator of global trade cycles. Adjustments of the BDI are mostly a result of changes in demand for raw materials as the supply in transport ships is fixed in the short term.

at a high level historically. In December 2021 an index of the International Grains Council (IGC), which specifically depicts freight rates for grains and oil seeds, was also around 90 per cent higher than the level for the previous year. Particularly in the food trade, where the value to weight ratio is low, transport costs are a key cost factor. For example, over the past decade the transport costs of

wheat on the maritime route from the Black Sea to the Suez Canal have represented on average 5 per cent of the import price. Even on this relatively short route, a doubling of these costs can, therefore, lead to considerably higher prices in crisis-prone importing regions like the Middle East, which in recent years have been frequently threatened by food riots.

Figure 2: Baltic Dry Index (BDI), 2010-2021

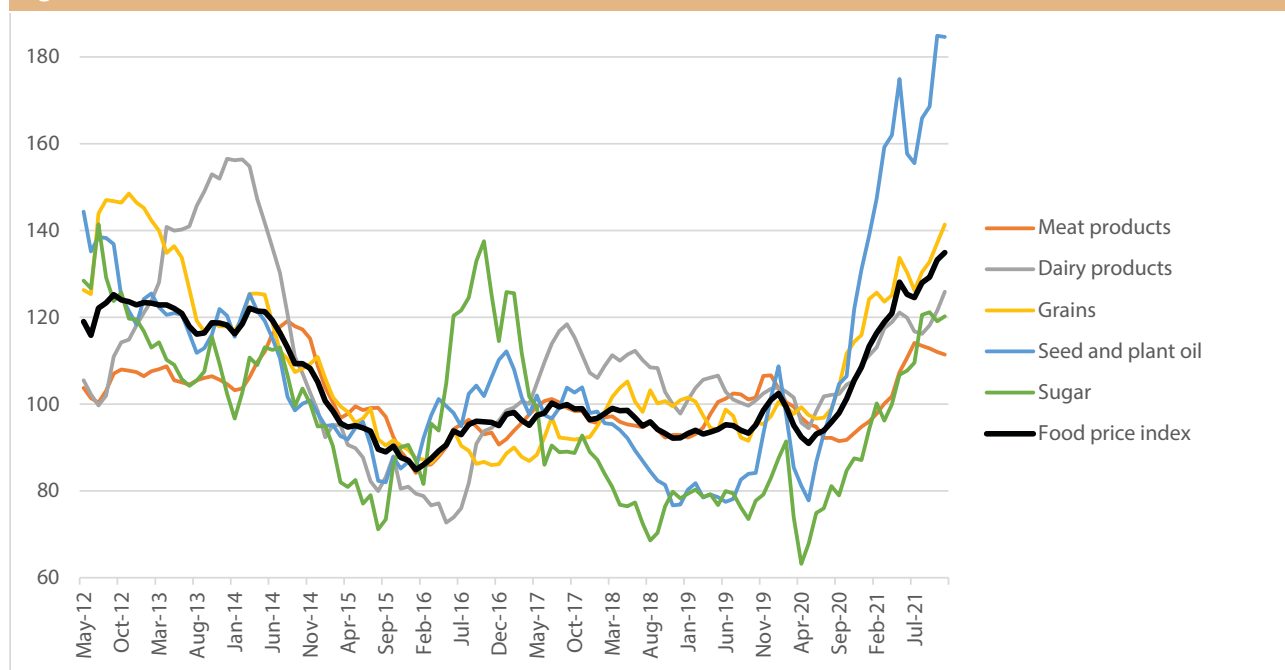


Maximum food prices

Besides construction materials and industrial raw materials, 2021 also saw substantial price rises in agricultural raw materials. For example, the global FAO food price index, which is compiled monthly, is currently 40 per cent higher than the average level in 2019, and thus in real terms has reached price levels last seen in the 1970s (**Figure 3**). Rising prices are occurring in all subgroups, but basic foodstuffs such as plant oils and grains have seen the greatest hikes by comparison to 2019, of 114 and 45 per cent respectively.

Amongst the reasons for the increase in grain prices are the ongoing high levels of Chinese feed imports as well as concerns over maize harvests in South America and the USA. More restrictions on grain exports by Russia, the largest global wheat exporter, is another driver. Because of high domestic inflation in food prices, the Argentinian government also decided at the end of June 2021 to intervene to massively reduce exports of beef. Such trade-restrictive policies harbour a high risk for global food security (Falkendal et al., 2021) and can persist in an

Figure 3: FAO Food Price Index and sub-indices, 2014-2021



escalation of panic buying and subsequent measures by other exporters or importers.

Combating a food crisis

As mentioned above, the first year of the pandemic in 2020 saw a historic rise in global poverty, which is anticipated to level off at least in 2021. Whereas initially, overall global agricultural trade seemed barely affected, new research for 2020 has identified in particular a decline in agricultural trade of non-foodstuffs as well as meat products and seafood. This downturn, which especially impacted the region of sub-Saharan Africa, points to a deterioration of the already critical food situation in poorer regions of the world. Increasing anomalies in global maritime trade have also been seen as a result of the increased strains on the global economy. These are manifested in a hike in maritime freight rates, which represent a considerable cost factor for global agricultural trade in particular. Moreover, the FAO's global food price index has recorded a continual increase in the price of foodstuffs since the middle of 2020. In view of an accelerating rise in exports, some important food-exporting countries are considering trade restrictions or are already implementing these to ensure their own food supply.

All in all, the developments outlined above harbour considerable additional risks for global food security. Given the global crisis in the supply of adequate levels of food, it must be hoped that the aforementioned restrictions will soon be lifted. Yet again we have to stress the importance of well-functioning interregional trade and make an emphatic demand for greater international cooperation. Calls for regional self-sufficiency or

even systemic changes in agricultural production along planned-economy lines, such as have been heard within the EU for example, endanger food security from a global perspective, especially in regions dependent on imports. From the viewpoint of agro-economic research, in future it is necessary to place a sharper focus on the pricing, functioning and organisation of maritime freight markets, because freight costs represent a substantial cost factor particularly for agricultural trade.

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Diagram sources and acknowledgements

Title Loading grain into holds of sea cargo vessel through an automatic line in seaport from silos of grain storage. Bunkering of dry cargo ship with grain © Elena - stock.adobe.com

Fig. 1 COVID-19 Stringency Index, 21. Dezember 2021 © Our World in Data – <https://ourworldindata.org/grapher/covid-stringency-index> (2021)

Fig. 2 Baltic Dry Index (BDI), 2010-2021 © authors' graphic. Daten: Baltic Exchange (2021)

Fig. 3 FAO Food Price Index und sub-indices, 2014-2021 © authors' graphic. Data: FAO (2021)



Arjola Arapi-Gjini and Judith Möllers

Migration, remittances and well-being in Kosovo

Migration, remittances and well-being in Kosovo

Arjola Arapi-Gjini and Judith Möllers

Due to its rather narrow focus on the economic impacts of remittances, the global migration debate has, until lately, overlooked the much more complex experiences of millions of individuals who stay behind in - mostly rural - migrant-sending communities. The question of whether migration has a positive impact on the lives of those staying behind necessitates a better understanding of both the economic and non-economic welfare effects of migration (i.e., effects on individuals' life satisfaction, sense of autonomy and empowerment) so that adequate policies can be designed which maximize the development potential of migration.

We approach the scientific debate on how migration, remittances and well-being interact through the empirical case of Kosovo. The country ranks fourth among the top ten remittance-dependent European and Central Asian transition economies (World Bank, 2018). Like

many other countries in the region, Kosovo is strongly affected by migration and remittances, but is widely under-researched with respect to the development and welfare effects of these remittances.

Economic welfare effects of migration

Becoming better off or worse off undoubtedly requires advances in economic (material) welfare. Remittances are known to be effective in alleviating poverty. Using a nationally representative dataset and state-of-the-art matching techniques, we measure poverty effects based on counterfactual scenarios. The counterfactual scenario represents a situation in which a similar (matched) household does not benefit from migration. This avoids any biases that a direct comparison of migrant to non-migrant households would bring about.

Tabelle 1: Poverty in Kosovo, 2011

	Yearly income (€)	Poverty incidence (observed income)	Poverty incidence (counterfactual incomes)
Absolute poverty line €1.72 line, 2011 prices*	628	0.03	0.04
€1.20 line, 2011 prices*	438	0.01	0.02
Relative poverty line 60% of sample median**	1,337	0.20	0.24

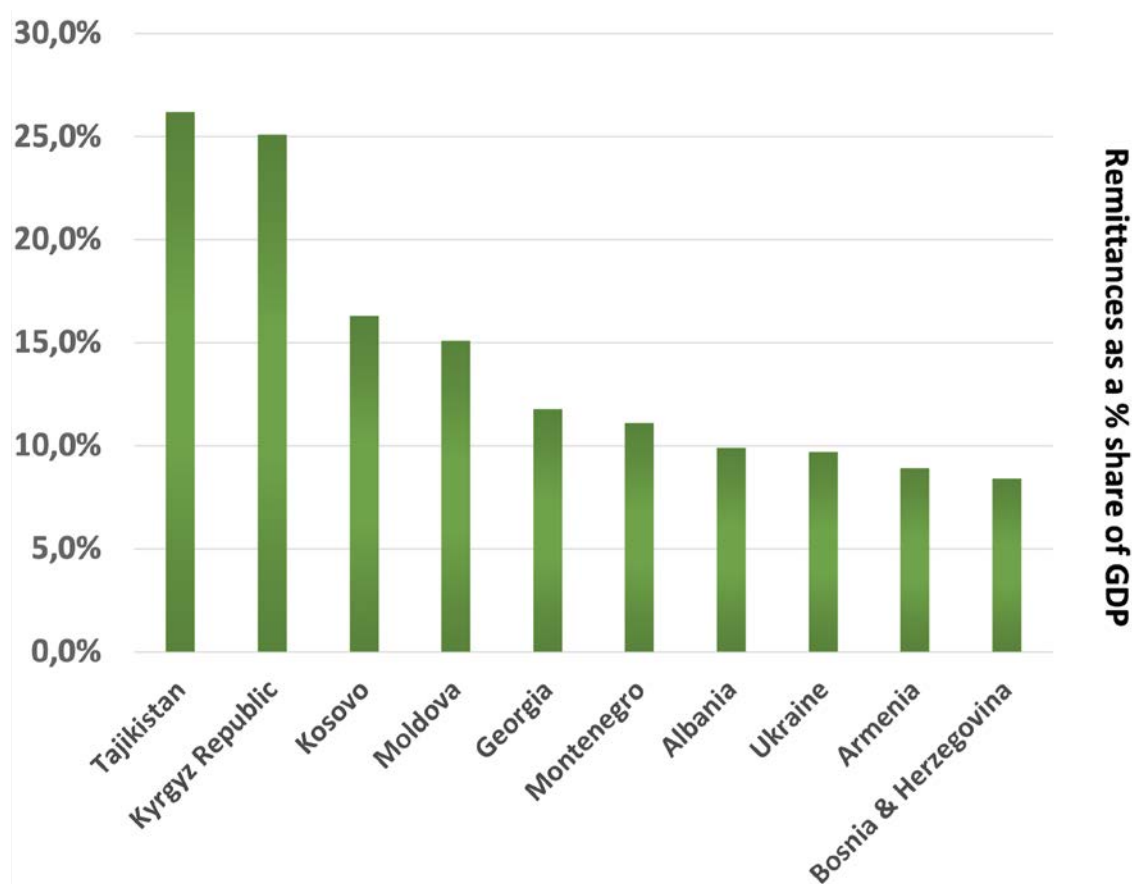
*Absolute poverty line used by the World Bank for Kosovo using a cost of basic needs approach for 2011.

**This poverty line corresponds to 60% of the median equivalized per-capita income within the sample.

Our findings show that, in the case of Kosovo, remittances alleviate both absolute and relative poverty levels (**Table 1**). For instance, using an absolute poverty line of €628 per person and year (€1.72 per person per day) and relying on the observed income of households, we estimate that 3 per cent are considered poor (Table 1). In the case of the counterfactual scenario where there is no migration, the proportion of the poor increases from

3 per cent to 4 per cent. However, if the relative poverty line (€1,337 per person per year) is considered to be 60 per cent of the median income for the sample, we get a poverty rate of 20 per cent, which increases to 23 per cent when remittances are not accounted for, and up to 24 per cent when the counterfactual income (scenario with no migration) is used as a welfare indicator.

Figure 1: Top 10 remittance-recipient countries in Europe and Central Asia

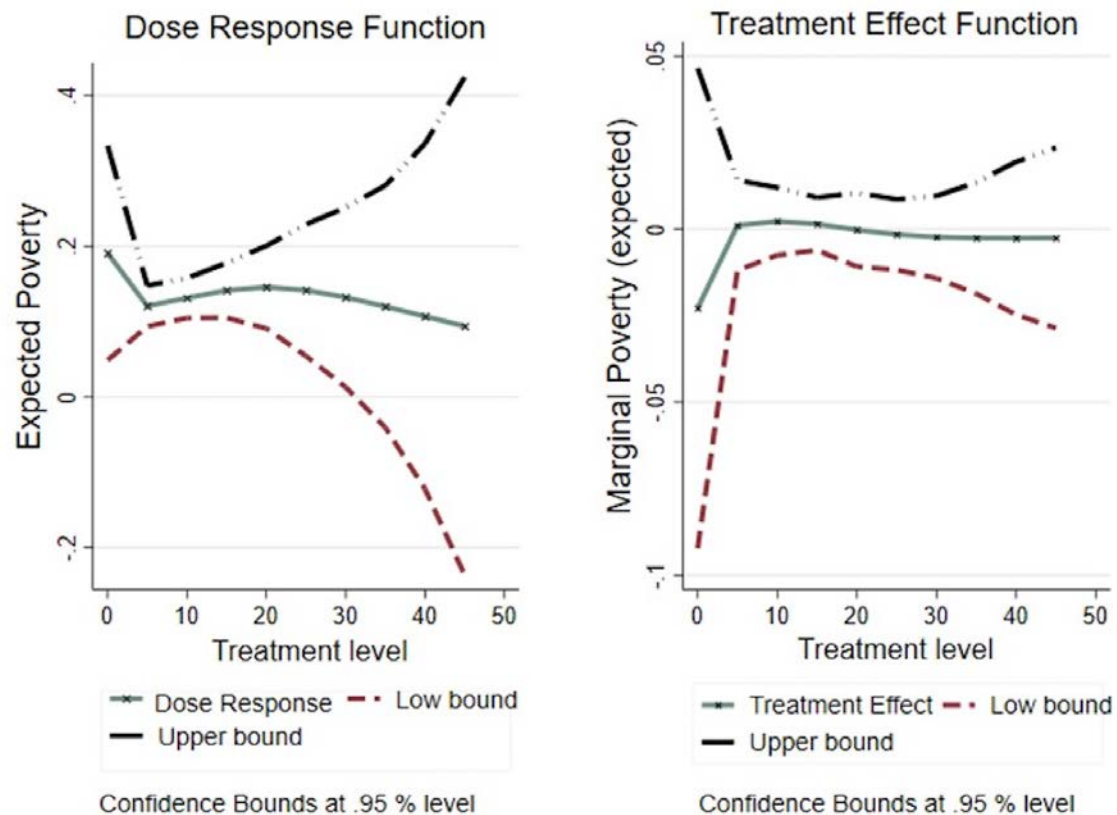


GDP= gross domestic product

Furthermore, using a dose-response estimation function (Imbens, 2000; Keisuke & Imbens, 2004) we find evidence that the relationship between poverty and the length of time that households received remittances is such that remittances have a positive, poverty-reducing effect over time (**Figure 2**). However it should be noted that the ef-

fect is stronger in the first five years in which a household is exposed to a remittance, thereby suggesting that the decreasing poverty effect of remittances may be stronger in the short run. In the very long run, the effects of remittances flatten out, suggesting that factors other than receiving a remittance, become more important.

Figure 2: Dose response function and estimated treatment effect on poverty



Broader well-being effects of migration

Participation in migration and remitting patterns may be linked to broader and sometimes contradicting outcomes of well-being beyond that of economic welfare. What this means is that an increase in income (and subsequent reduction in poverty) may not necessarily translate into perceived improvements in life satisfaction, autonomy and empowerment by those individuals that migrants leave behind.

These effects are the focus of a qualitative study conducted in Opoja, a sending area for migrants in a mountainous area in southern Kosovo that borders Albania and North Macedonia. Using a face-to-face approach with the senders and recipients of remittances, our research gained an in-depth understanding of issues that escape the standardized and narrower optic of surveys by assessing the less direct, non-economic welfare effects of migration on the well-being of individuals living in migrant-sending communities.

The first key insight is that social comparisons to migrants play an important role in the well-being of individuals living in migrant-sending communities. Migrants are not only the saviors and protectors that shield families and entire communities from poverty and destitution, their exuberant display of wealth causes mixed feelings of envy and, in other cases, ambition among different demographic groups of people. Social comparisons to migrants significantly influence the migration aspirations of young Kosovars, who compare their life prospects to those of the migrants abroad and view migration as their only viable opportunity for a livelihood. Young men are easily impressed by the shiny new cars that migrants bring back with them, the new houses that migrants build, and the money they spend in Kosovo. Many feel a heightened sense of envy and disappointment, especially during the summer months when most migrants return home.

*Young people here envy the lives of their peers [migrants], they think [migrants] earn money very easily, they think life abroad is easier.
(Fitim, 08/2016)*

For another group of people, middle-aged couples with children and no migration experience, the prospect of migration is an ambitious objective. This group uses comparisons to migrants to form expectations about their children's future. The apparent life trajectories of migrants signal future opportunities and many view their children's migration prospects with feelings of opti-

mism. Similar to the young men, this group seems oblivious to the difficulties associated with migration. The onus for this lies partly with the migrants themselves, who, in a bid to maintain their social status in their communities, do not speak openly about the struggles they face abroad. In doing so, they unwittingly mislead those staying behind in their hopes to potentially migrate.

Figure 3: New village houses of two migrant brothers (Opoja, Kosovo).



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Social comparisons to migrants also play an important role in the relatively low motivation of young people to participate in the local labor force. Many compare their current work engagements and future job prospects to those of migrants abroad and are not motivated to work in Kosovo. But this is only one facet of the story. Our analysis shows that it is, in fact, the receipt of regular remittance transfers that enables young people to withdraw their labor from the local market (particularly in the agriculture sector and in low-skilled niches of the private sector). With most households owning a house, and basic food needs covered by remittances, there is little urgency to accept low-paid and unattractive job offers. Disengaging from work is thus facilitated by the receipt

of remittances. However, refraining from employment and other work-related activities negatively impacts the well-being of young men and their families in the short- and long-run. Many experience the negative feelings of discontent and pessimism: not only do the highly educated feel more and more anxious and restless as time goes by due to the realization that their dreams of migration may never come true, they struggle to find local jobs that meet their expectations.

In comparison, self-reliant people who have managed to build their lives without remittance support are more motivated overall and less despondent about their future.

It is the need for survival that pushes you.... If you have no other option, you have to deal with what you have, to fight with what you have (Afrim, 08/2016).

Finally, migration hinders empowerment, an important facet of the well-being of women. As our investigation reveals, there is a causal relationship which follows a trajectory: migration and remittances influence a woman's work, which in turn affects her empowerment and ultimately impacts her well-being. Over the years, access to remittance income has disproportionally affected the productive work of women within a household while also increasing barriers to participation in paid employment. By increasing incomes, remittances have enabled households to transition from a production unit (i.e., one

at the heart of which stood the traditionally productive activities of women, like sewing, knitting and livestock production) into a consumption unit, whereby most products are purchased outside the house. Moreover, remittance transfers have lowered the incentive for women to participate in paid work. This is particularly true in the context of a highly traditional setting where women do not have the free will to choose whether to work or not. Instead the decision to allow a woman to work usually lies with other people higher up in the household's hierarchy.

All day here I only clean the house, up and down, all day, nothing. Nothing will change [for the better] here. Nothing. As long as I live. Waiting for someone to bring you something [remittances from abroad] but no opportunity to work yourself, to be free to work yourself. (Besa, 08/2016)

A common thread that runs through the stories of all of the women in migrant households is dissatisfaction, anxiety, worry and pessimism about their own future. Many express a deep and powerful desire to engage in meaningful work, which they do not simply see as a source of income but also as a way to attain independence, agency and self-worth so that they can be agents of change in their own life. In contrast, women in non-migrant households are more likely to undertake productive work, which comes with higher degrees of empowerment and well-being.

As our study shows, investigating less direct, non-economic welfare impacts is crucial to better understanding the well-being outcomes of migration. In addition to the positive, poverty-reducing effects, there are other equally important issues that must not be overlooked. Based on these insights, we propose that the agenda on migration and development views improvements in well-being as a dynamic process; one that includes not only material welfare, but also other aspects of well-being, such as, individual happiness, independence and empowerment.

Figure 4: Woman in a migrant household baking byrek in a wood-fired oven (Opoja, Kosovo).



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Diagram sources and acknowledgements

Title Tractor IMT 539 Deluxe (Opoja, Kosovo) © Own photograph

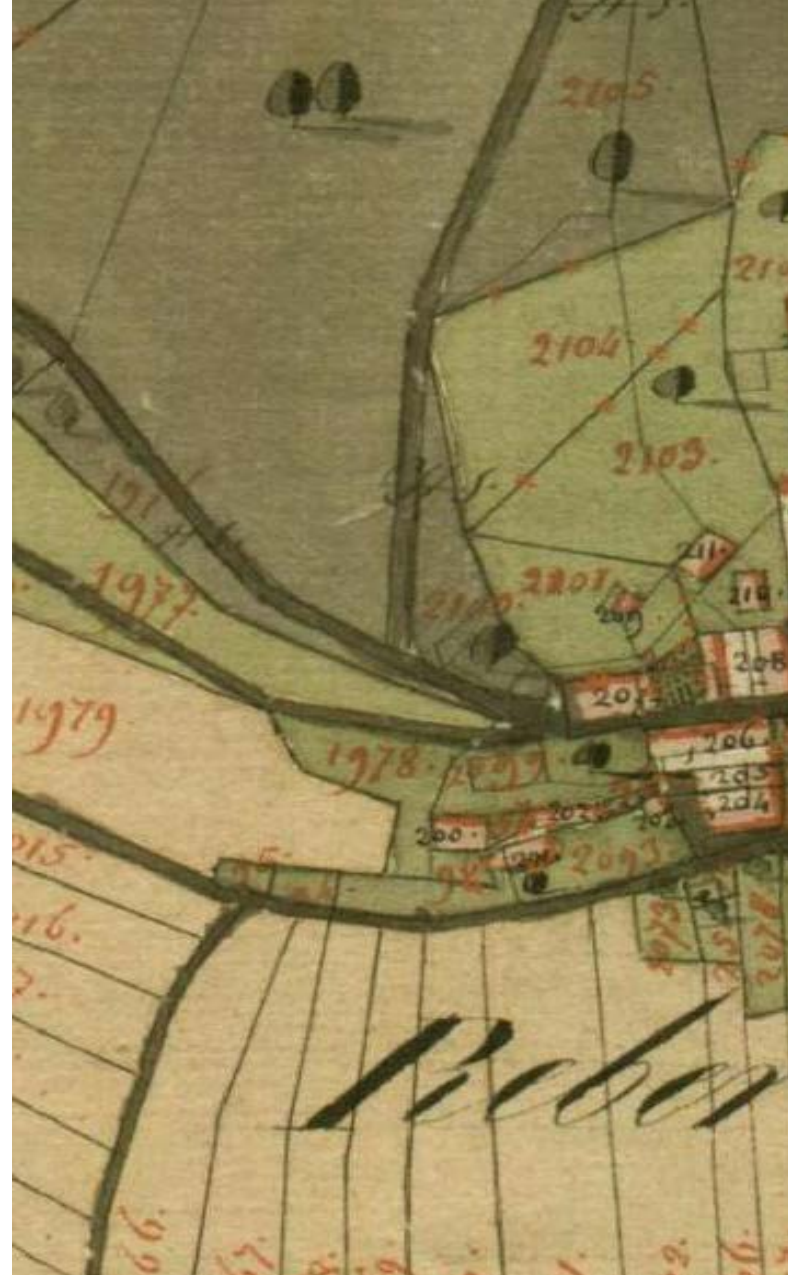
Tab. 1 Poverty in Kosovo, 2011 © Own calculation based on the household-level dataset from the „Kosovo Remittance Household Survey“ (KRHS) 2011

Fig. 1 Top 10 remittance-recipient countries in Europe and Central Asia © Own compilation Data: World Bank – KNOMAD estimates for the year 2020 – <https://www.knomad.org/publication/migration-and-development-brief-33>

Fig. 2 Dose response function and estimated treatment effect on poverty © Own calculation based the household-level dataset from the „Kosovo Remittance Household Survey“ (KRHS) 2011

Fig. 3 New village houses of two migrant brothers (Opoja, Kosovo).© Own photograph

Fig. 4 Woman in a migrant household baking byrek in a wood-fired oven (Opoja, Kosovo). © Own photograph





Magnus Neubert and Michael Kopsidis

The historic roots of regional diversity in former Yugoslavia

The historic roots of regional diversity in former Yugoslavia

Magnus Neubert and Michael Kopsidis

Introduction

Even today former Yugoslavia is marked by large regional income disparities. Despite a conscious policy of harmonising living standards during the socialist era from 1945 to 1991–92, regional divergence became more entrenched (Kukić, 2020). Under free-market conditions in the now independent successor states of former Yugoslavia, the economically weaker countries have not experienced a process of growth to catch up with their neighbours. It is noticeable that the high-income regions after 1945 had been part of the Habsburg Empire prior to 1918, whereas those areas with below-average per-capita income all belonged to the Ottoman Empire for long periods in their history. Since the 18th century at least, both empires had shown great differences in their state building process, namely concerning their state capacity.

State capacity describes the ability of a state to collect taxes via an efficient central administration and invest this revenue in public goods such as education, law, defence or infrastructure. Modern growth and development theory regards state capacity as an essential condition for the transition to self-sustained modern growth,

especially in processes of catch-up growth in areas that were formerly underdeveloped economically (Ogilvie & Carus, 2014; Dinecco & Katz, 2016; Johnson & Koyama, 2017). In accordance with modern growth theory we will consider whether a determining factor of regional divergence within former Yugoslavia was, or is, the fact that areas belonged to different empires over a long period of time before 1918.

This research project uses modern growth theory methods and an intricately refined historical data set, which for the first time captures small-scale data on economic strength down to the district level for the period prior to the Second World War. It is the first econometric evaluation of the impact of different state capacity on regional economic development. Using an evidence-based approach it examines the notion that historical structural differences can explain regional divergence within Yugoslavia.

Historical background

Yugoslavia was first established as a multinational state in 1918 in the aftermath of the collapse of Austria-Hungary. Over several centuries its territory was – broadly speaking – governed by the Habsburg Empire in the north and the Ottoman Empire in the South. With the Principality of Serbia in 1815, which along with Montenegro only attained full independence in 1878, national states on the territory of the future Yugoslavia seceded from the Ottoman Empire for the first time, while Ottoman Bosnia-Herzegovina was occupied by Austria-Hungary in 1878.

Especially in the second half of the 18th century, the state capacity of the Habsburg Empire and the Ottoman Empire started to develop differently. The Habsburg Empire became a centre of enlightened absolutism and began building a modern state. In the Ottoman Empire, by contrast, a complex combination of factors led to serious signs of decay. Instead of growing, the statehood began falling apart. It wasn't until the second third of the 19th century that this process was halted temporarily.

The causes of this very differing development of state capacity are many and varied, but the consequences of the divergence were dramatic. Even by overall European standards the Habsburg Empire managed to develop a modern cadastral system relatively early, a task that the Ottoman Empire and the newly founded nation states on its territory were unable to accomplish – in some cases this is still true today. In 1795, even before the French

Revolution, the first equal and general taxation of land in Europe was carried out in the Habsburg Empire. 1806 saw the start of a systematic land survey to map the entire territory of the empire. The resultant land register included buildings and plots of land, allowing the creation of title deeds and evaluating the profitability of individual plots of land. First the Austrian half, and then the Hungarian half of the empire was recorded by the cadastral system (Scharr, 2015). The land register was efficiently run by a reliable administration and allowed for increasing tax revenue in a largely agrarian economy. At the same time the land register incentivised farmers to improve the potential yields of their plots, because secure rights of ownership were guaranteed by the state.

In the Ottoman Empire, on the other hand, the leasing of tax revenues to private individuals replaced the feudal Timar system. The government auctioned taxation rights to the highest bidders, who then established a corrupt, opaque system of tax collection. They failed to introduce a centralised financial administration as existed in the Habsburg Monarchy, and the Ottoman Empire fell far behind other European powers as far as state capacity was concerned (Karaman & Pamuk, 2010, 2013). Regulated cadastral practices as in the Habsburg Empire were unusual. If at all, deeds of ownership (*tapijska knjiga*) were only drawn up without measuring land holdings. Some taxation on land was based on self-declaration or had to be paid in kind (tithes and serf labour). This did

not change to any significant degree in the newly established independent states to begin with. In Serbia the tax burden of the state-bearing and influential peasantry even fell after independence. Later, however, Serbia did manage to raise per-capita revenue via a centralised financial administration and greater taxation of the urban middle class.

This diverging development of state capacity in the territory of the future Yugoslavia was also reflected in the investment in public goods. Increased revenue allowed the Habsburg Monarchy to begin developing primary school education with compulsory attendance for all as early as the 1770s. In 1849 the first stretch of railway was built on Yugoslav soil and by 1912 a dense railway network had been established. Beyond land-ownership rights, a reliable central administration also implemented legal norms throughout the entire Habsburg Empire, thereby achieving a high degree of legal security. The Ottoman Empire could not compete with the Habsburg Monarchy: compulsory schooling was never introduced and education remained a privilege of the elites. A rudimentary privately owned railway network did develop very late, but it was never expanded. All attempts to introduce throughout the empire a strong administration that observed rules likewise failed in the face of resistance from powerful local elites, who instead were responsible for a very unequal implementation of legal norms. In independent Serbia, too, an underdeveloped state capacity hampered investment in public goods. It was only under pressure from Austria-Hungary that the state began constructing a rudimentary railway network in 1884. Compulsory schooling was not introduced until 1882 and only brought in for boys. Little is known about Montenegro, but after independence there were

at best a few modest attempts at modernisation. Modern property rights were introduced (1888), compulsory schooling became official (1879) and a first, albeit isolated, stretch of railway was built (1909) (Treadway, 2021). In both Serbia and Montenegro the lack of finance and expertise hindered the implementation of reforms.

In conclusion, the establishment of Yugoslavia in 1918 produced a state, parts of which had not only suffered heavy losses and damage in the war, but also had a high degree of socioeconomic and institutional heterogeneity. A desperate shortage of money as well as a lack of expertise and the political polarisation between Serbs and Croats hampered a standardisation of the tax, legal and education systems in interwar Yugoslavia. The marked regional differences in degree of statehood, or in the development of efficient public institutions as a prerequisite for a modernisation of the economy remained almost undiminished in the interwar period. There is much evidence that this was a decisive factor solidifying regional divergence within Yugoslavia.

Data and methods

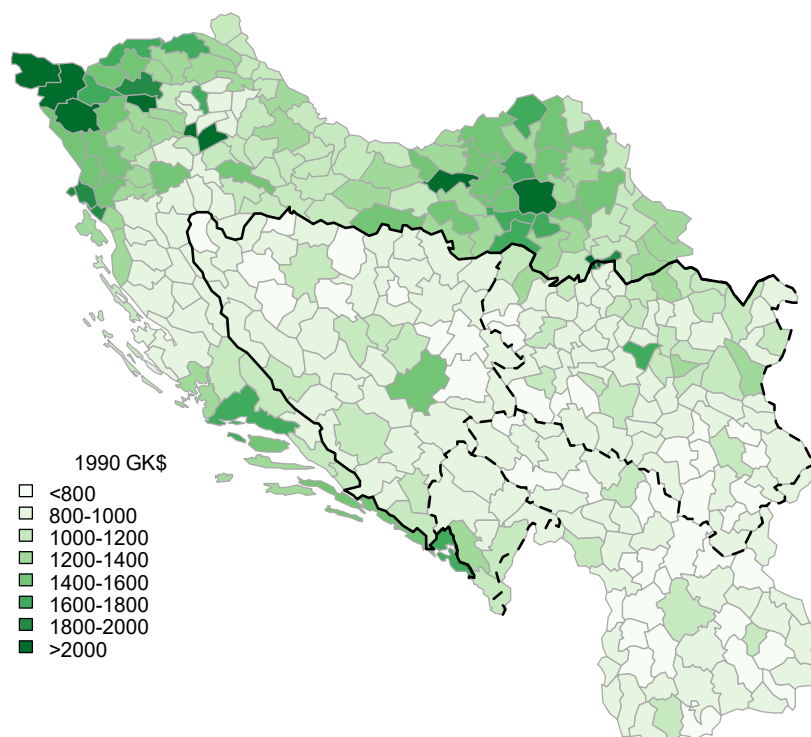
There are no uniform statistics for the territory of Yugoslavia for the period before the First World War. The earliest source we can use for a large and small-scale quantitative comparative analysis of regional differences is the first pan-Yugoslavian census of 1931. This does, however, give an adequate reflection of the inner-Yugoslavian differences prior to the outbreak of the First World War. Besides the obligatory population count, the 1931 census contains records of literacy and employment by individual sectors of the economy for 346 districts (*srezovi*).

By using the data set, digitalised for the first time, along with additional historical sources, and following the methodology of Geary and Stark (2002), the estimation of Yugoslavian GDP for 1931 from the Maddison database (Bolt et al., 2018) can be downscaled for the individual districts. As **Figure 1** shows, depicting the per-capita gross domestic product by district or overall labour productivity for 1931, economic development in those regions ruled for a long period by the Habsburg Empire was much further advanced, or per-capita income was considerably higher. In Slovenia and the Vojvodina (today Northern Serbia) initial industrial clusters had formed, which did not exist in those areas ruled for a long time by the Ottoman Empire. A regression discontinuity analysis along the more or less stable border between the Habsburg and Ottoman Empires (unbroken line) from the end of the 18th century to 1878 allows us to estimate the causal effect of long-term Habsburg rule on the economic performance of a region and establish whether the development of productivity benefited from the substantially higher Habsburg state capacity. This also allows us to see whether state capacity induced a positive economic impulse to growth.

The 1931 census also enables us to research the trans-

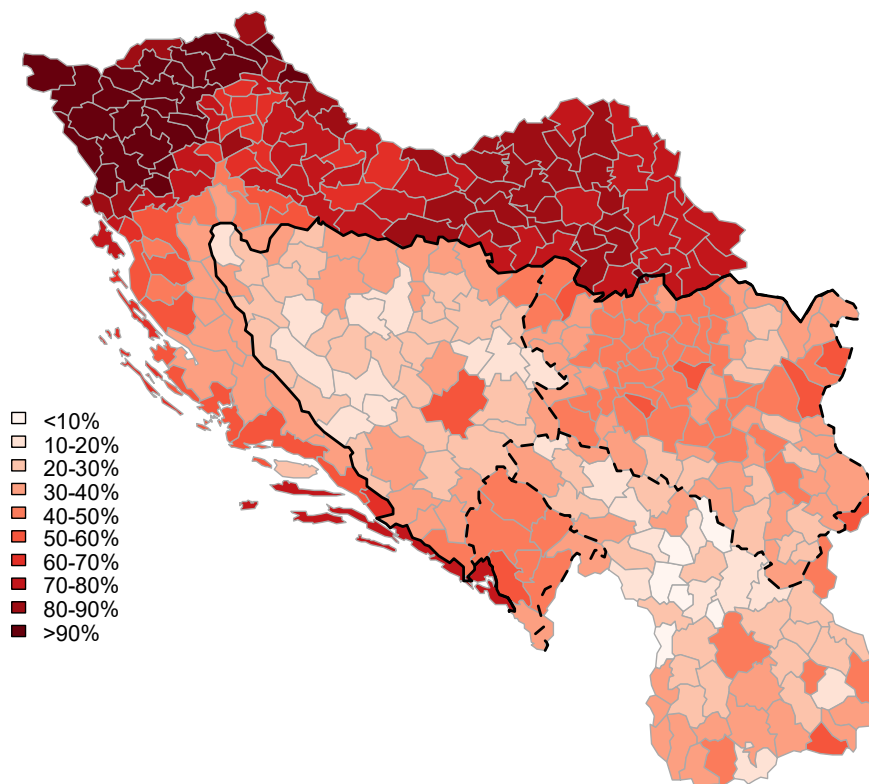
mission mechanisms via which state capacity increases productivity. Modern growth theory implies that legal institutions and transport infrastructure have a positive influence on economic growth, something which is supported by countless empirical studies. The degree of literacy has proved to be a good indicator of key aspects of human capital, especially for pre-industrial countries and those in the early stage of industrialisation. Rates of literacy or school enrolment are therefore used as a measure of human capital, particularly in studies on phases of the transition to modern growth.

Figure 1: Per-capita gross domestic product (GDP) in Yugoslavia, 1931 (in 1990 international Geary-Khamis dollars)



The census data in **Figure 2** show quite clearly what has already been stated: the school system in the Habsburg Monarchy was extremely effective. The differences between Serbia and Montenegro on the one hand and the Ottoman regions as well as Bosnia-Herzegovina on the other are also clearly apparent. Broken down by sex we see that the higher literacy rates in Serbia and Montenegro were achieved by boys going to school, whereas girls continued to be denied education. The visible correlation between literacy and per-capita GDP suggests that there was a positive connection here too.

Figure 2: Literacy rates in Yugoslavia, 1931



Measuring the quality of legal institutions or the efficiency of the state apparatus is more difficult as only input data exist – e.g. workforce numbers – but no output data to permit us to judge the efficiency of the legal system, for example. Lacking better data, we can take a category in the occupational census as a proxy variable: “Officials, freelancers and army”. We begin by extensively clearing the variable of members of the army and state officials working for the executive, so it can serve as a proxy for the quality of legal institutions. An effective guarantee

of property rights, for example through a cadastral system or a high-powered legal system, requires a large number of officials, but also freelancers such as lawyers or notaries. In this concrete historical case, the concentration of such official and freelancers gives a good approximation of the quality of the legal institutions. At first glance, however, regional differences do not follow the usual pattern so clearly, as **Figure 3** shows. For Yugoslavia as a whole, a difference between urban and rural areas is more evident. A closer examination of the data, on the other hand, shows that here too the regions marked by Habsburg rule were at an advantage. The mapping of the railway system in **Figure 4** has been taken from historical railway maps

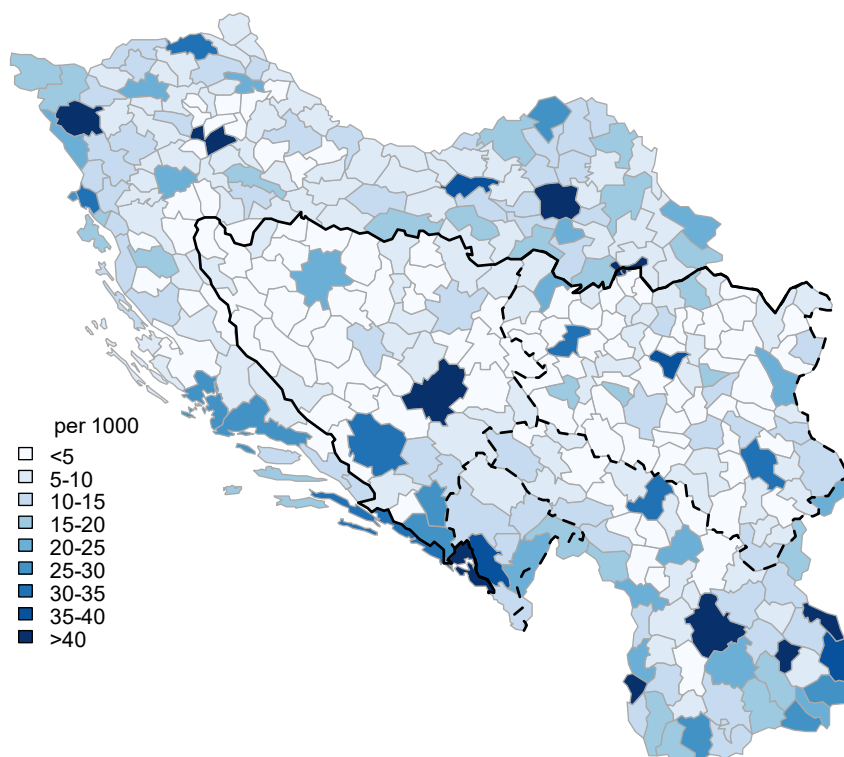
rather than the census. The aforementioned difference in network density between Habsburg and Ottoman regions is very marked. It should be noted, moreover, that the impact of the First World War on the different Yugoslav regions varied considerably. **Figure 5** shows that Serbia suffered particularly badly in the war, losing a quarter of its entire population. The Muslim-Albanian population in what is today Kosovo and North Macedonia had already suffered large losses during the Balkan Wars of 1912–13. These population losses were calculated by consulting individual censuses carried around 1910 and the first Yugoslav census of 1921. Population losses due to the war must be accounted for in the econometric assessment as they might have had a negative impact on productivity in 1931, which had nothing to do with the state capacity of the pre-war states.

Summary

In conclusion, even looking at geographical differences prior to an econometric analysis suggests that the persistence of the marked economic divergence between the regions of Yugoslavia has its roots in the centuries of division of Yugoslav territory between the Habsburg and Ottoman Empires. The substantially

higher state capacity of the Danube Monarchy enabled it not only to collect more tax revenue, but also to invest this revenue into public goods. Particularly the development of an elementary school system and the implementation of efficient legal institutions such as a cadastral system prepared the groundwork for strong economic growth in the regions concerned. This might also help explain why Slovenia and Croatia, which belonged for a long time to the Habsburg Monarchy, have been accepted into the EU whereas the other post-Yugoslav states have not yet.

Figure 3: Concentration of legal and cadastral officials as well as legal free-lancers in Yugoslavia, 1931 (people per 1,000 inhabitants)



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Figure 4: The railway network on the territory of future Yugoslavia, 1910



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Diagram sources and acknowledgements

Title Cadastral sheet of Gorenje Blato, Slovenia (1823) © Arhiv Republike Slovenije

Fig. 1 Per-capita gross domestic product (GDP) in Yugoslavia, 1931 (in 1990 international Geary-Khamis dollars) © authors' graphic

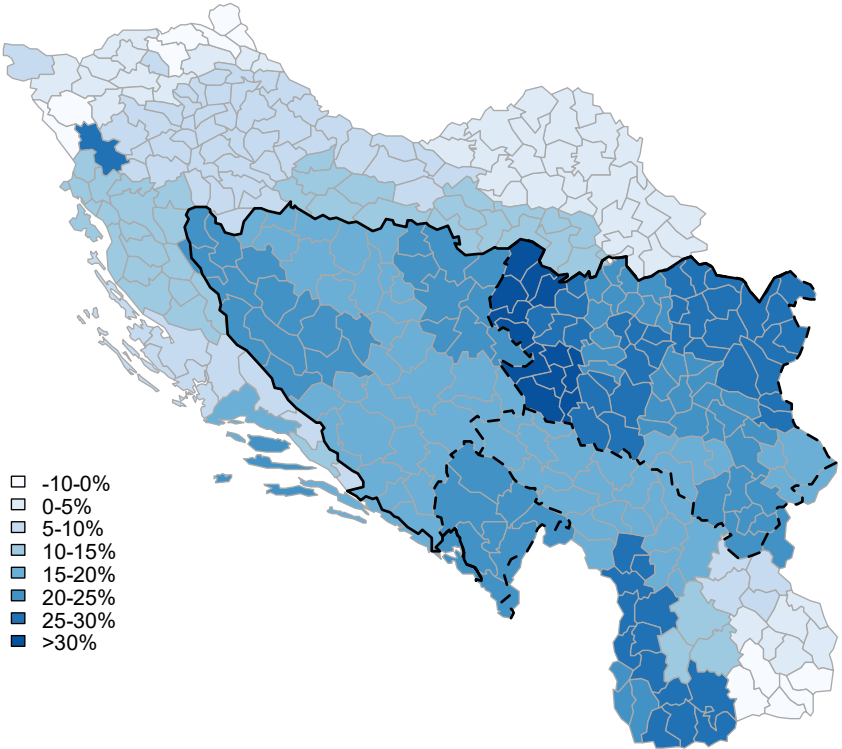
Fig. 2 Literacy rates in Yugoslavia, 1931 © authors' graphic

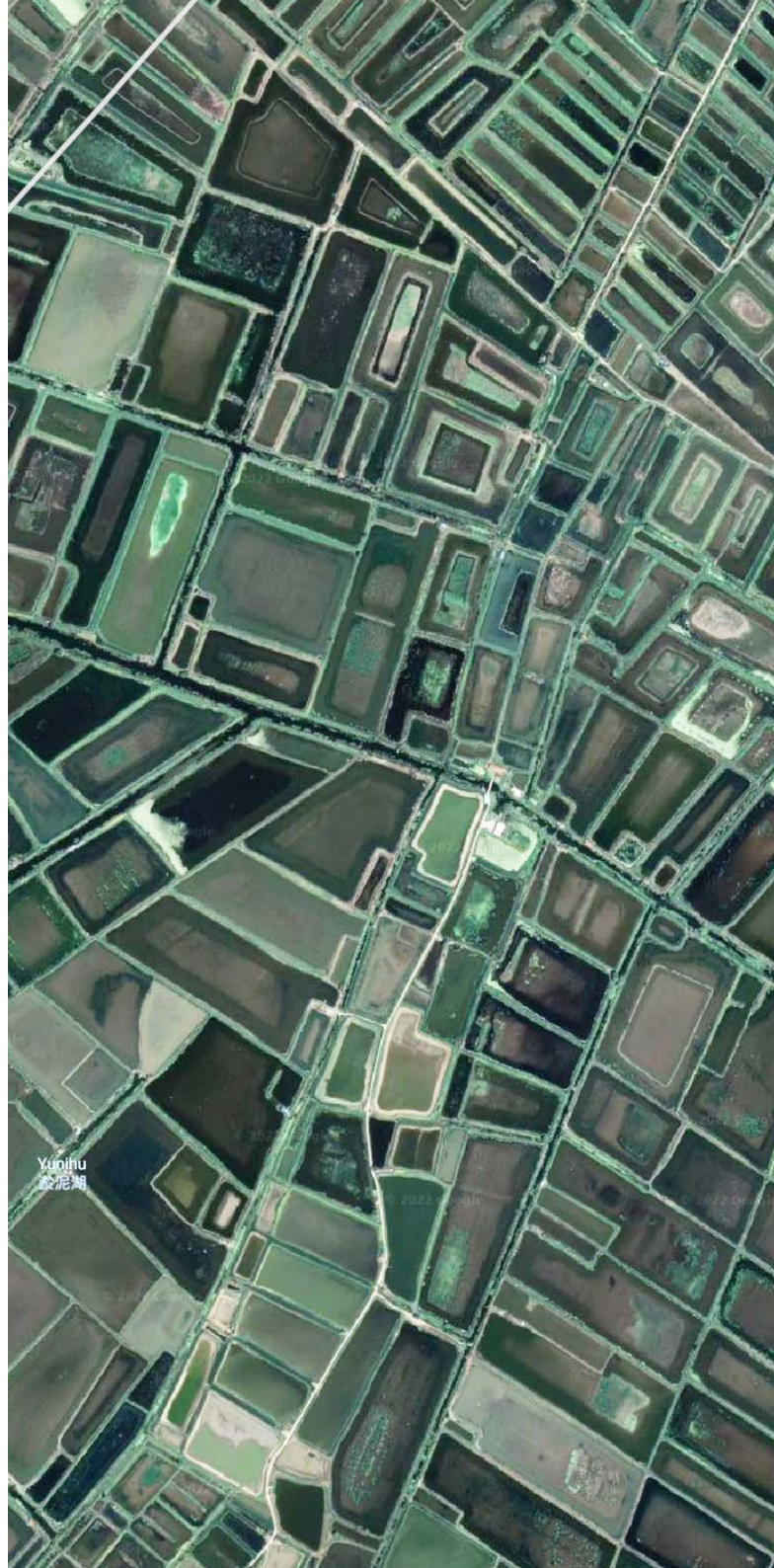
Fig. 3 Concentration of legal and cadastral officials as well as legal freelancers in Yugoslavia, 1931 (people per 1,000 inhabitants) © authors' graphic

Fig. 4 The railway network on the territory of future Yugoslavia, 1910 © authors' graphic

Fig. 5 Population losses on the territory of future Yugoslavia as a result of the Balkan Wars and the First World War, c. 1910–1921 (as a per centage of the projected population of 1921) © authors' graphic

Figure 5: Population losses on the territory of future Yugoslavia as a result of the Balkan Wars and the First World War, c. 1910–1921 (as a per centage of the projected population of 1921)





Yunhu
雲泥湖



Yunfan Lake
云帆湖

Li Lake
里湖

Yanbing Wei, Zhanli Sun and Daniel Müller

Satellite images reveal rapid spread of smallholder crayfish farming in China's rice fields

Satellite images reveal rapid spread of smallholder crayfish farming in China's rice fields

Yanbing Wei, Zhanli Sun and Daniel Müller

Introduction

Aquatic animals provide valuable protein for human diets, but the overexploitation of marine and freshwater animals threatens biodiversity and has caused ecosystem collapse (Food and Agricultural Organization of the United Nations [FAO], 2020a). The recent rise in aquaculture production has reduced pressure on capture fisheries and improved global food security. At the same time, aquaculture has become an increasingly important provider of livelihoods to small farmers especially in developing countries in Asia and Africa (Naylor et al., 2021).

Red swamp crayfish (*Procambarus clarkii*) are native to northeastern Mexico and the southern United States and are regarded as an invasive species in Asia. Recently crayfish have become a flourishing commodity in China due to the skyrocketing demand for crayfish as a popular urban street and snack food. In 2019, Chinese crayfish production reached two million tons, accounting for 96 per cent of global production (Zhang et al., 2021). Local farmers in Hubei Province began cultivating crayfish in rice paddy fields in the early 2010s. The integrated rice-crayfish farming system was approved by the China Fisheries Association in 2013 and has since received governmental support.

Combining crop production with fish and shellfish rearing in the same location generates important co-benefits such as nutrient accumulation, productivity and profitability (Bashir et al., 2020). In China, where only 0.1 hectares of cropland are available per capita (FAO, 2019), integrated aquaculture systems are a good way to make more efficient use of land resources, requiring less fertilizer input than traditional crop farming (Ahmed & Garnett, 2011).

We mapped the spatial expansion of rice-crayfish farming from 2013 to 2020 using high-resolution satellite imagery for the five key producing provinces, covering an area of 805,600 km². For comparison, Germany is 357,386 km². We used machine learning to single out the unique spectral and spatial features of integrated rice-crawfish farming for every year during the study period.

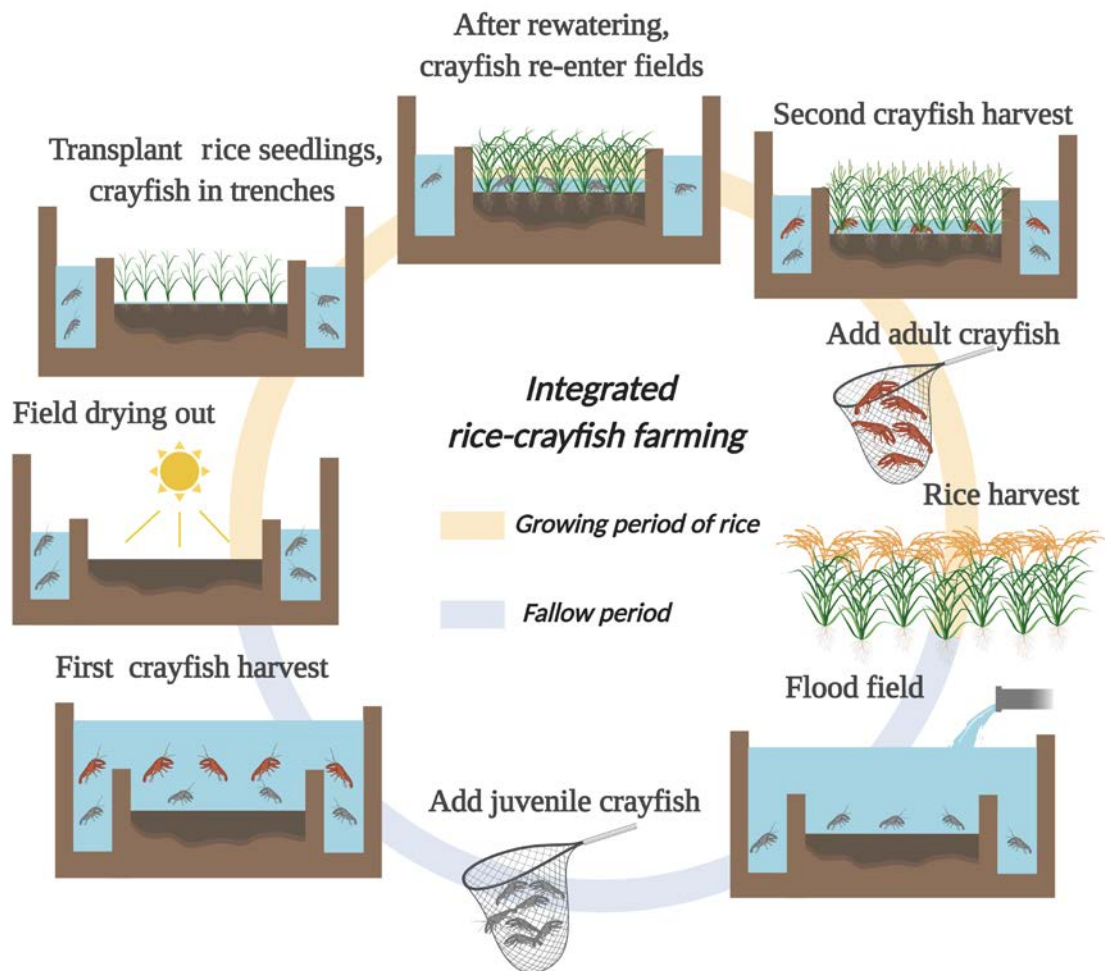
The integrated rice-crayfish farming system

The production process encompasses the rice planting period from June to October and the rice fallow period from November to May of the following year (**Figure 1**). The fields used for the integrated rice-crayfish cultivation system are surrounded by trenches which provide refuge for the crayfish when the paddy fields are dry.

The crayfish re-enter the paddy fields after the inundation in June when the young rice stems are strong enough to withstand the crayfish. Farmers add crayfish twice a year:

juvenile crayfish in March and adult crayfish before the rice harvest in September. Hence, a typical annual production cycle yields one rice harvest and two crayfish harvests.

Figure 1: The typical production cycle of the integrated rice-crayfish farming system



Mapping the expansion of integrated rice-crayfish production from space

We examined the five provinces of Anhui, Hubei, Hunan, Jiangsu and Jiangxi, which are the epicenter of global crayfish production. In 2019, these five provinces produced approximately 92 per cent of China's domestic supply of crayfish. The provinces are a traditional center of rice cultivation and have a subtropical climate. Paddy rice was cultivated on 14 million hectares in 2019, amounting to 48 per cent of China's total area used for rice cultivation (National Bureau of Statistics of China, 2020). The paddy fields along the river floodplains and lake shores provide ideal conditions for integrated rice-crayfish cultivation. Annual precipitation is between 800 and 1500 mm and temperatures range from 26°C to 30°C in summer and -1°C to 5°C in winter. Asia's longest river, the Yangtze, runs through the region and thousands of smaller lakes are scattered throughout the study area, including China's two largest freshwater lakes, Poyang Lake in Jiangxi and Dongting Lake in Hunan.

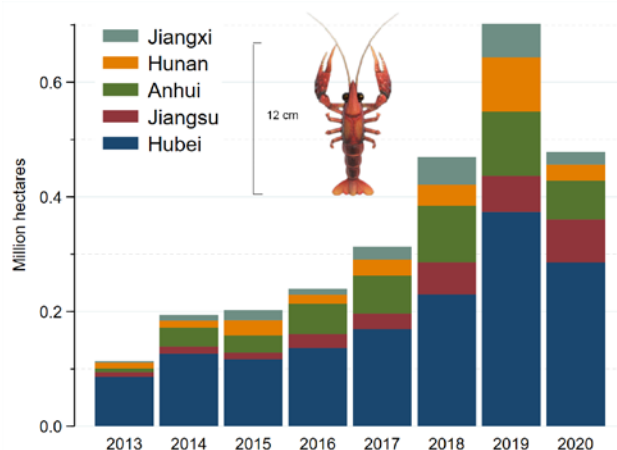
We mapped the spatial footprint of the integrated rice-crayfish system using Landsat satellite imagery. A machine learning algorithm was fed 1,300 randomly sampled pixels of integrated rice-crayfish farming and 1,138 pixels of other land-use types. All pixels were sampled from Google Earth imagery where the water trenches surrounding the rice fields were clearly visible. The resulting maps quantify the distribution of rice-crayfish production for each year from 2013 to 2020.

We found that integrated rice-crayfish farming reached its peak in 2019 at 7,020 km² but declined by one-third due to supply chain interruptions during the COVID-19 pandemic in 2020. Rice-crayfish production

started on the Jiangnan Plain in Hubei Province, where the system was first established in 2013. Hubei province's share in the five provinces' total rice-crayfish production decreased from 75 per cent in 2013 to 60 per cent in 2020. The strict lockdown in January 2020, enacted to curb the spread of the coronavirus, interrupted the supply chains for production inputs, particularly the supply of juvenile crayfish and feed. A sharp decrease in demand due to restaurant closures also contributed to the contraction of production.

Rice-crayfish systems are primarily located on plains at lower elevations where water resources are abundant and where agriculture has traditionally been dominated by paddy rice cultivation. Rice-crayfish production is concentrated within a few core zones on the Jiangnan Plain

Figure 2: Increase in area under integrated rice-crayfish cultivation in the five provinces studied for 2013 - 2020 and representation of an adult male crayfish that can reach a length of 12 cm



where it has become one of the most prevalent cultivation systems. In Hunan and Jiangxi provinces, rice-crayfish cultivation surrounds the Dongting and Poyang Lakes, while the rice-crayfish cultivation in Anhui and Jiangsu are scattered along the Yangtze River (**Figure 3**).

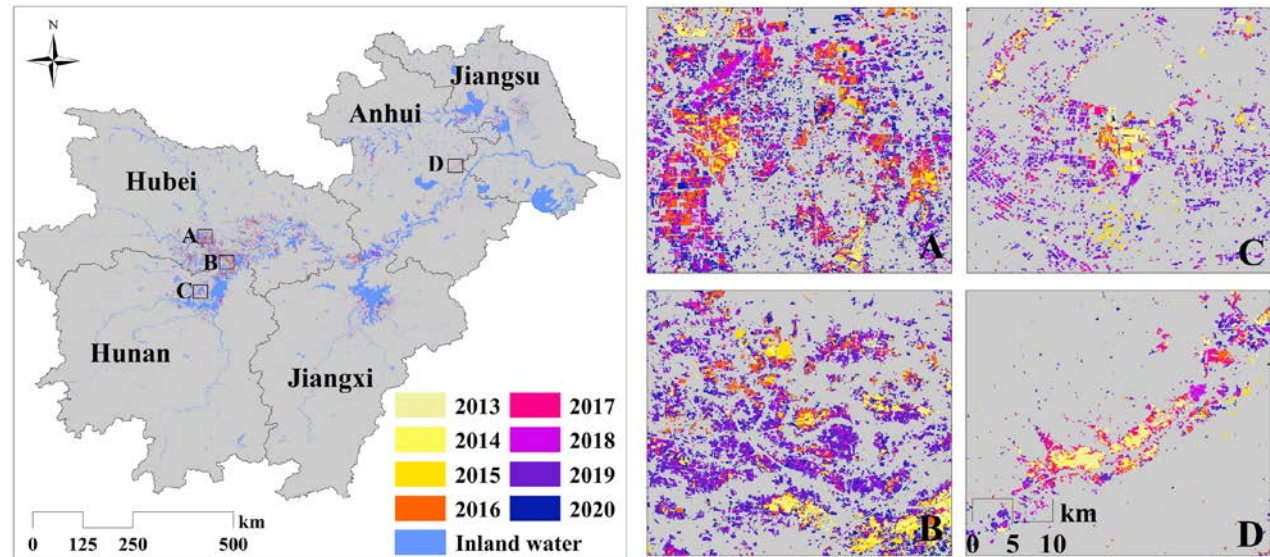
Drivers of the rice-crayfish expansion

The rice-crayfish system spread from southern Hubei in 2013 across the middle Yangtze Plain to Hunan and to the three downstream provinces, Jiangxi, Anhui and Jiangsu. These areas benefit from decisive locational advantages for crayfish and paddy rice production, including sufficient water resources, flat terrain, and easy access to the crayfish markets in Hubei. Hubei, with its megacity of Wuhan, is a large consumer market and the

largest crayfish trading center in China, with processing factories and a fully developed supply chain. Hubei crayfish have become a well-known brand with an excellent reputation throughout China. Wuhan is located at the intersection of many high-speed railway lines and on the Yangtze River; the ease of access facilitates rapid and low-cost crayfish supply. The combination of well-developed supply chains, a high (and rising) demand from affluent consumers, excellent transport connections, and suitable natural conditions have provided the perfect platform for the dynamic expansion of crayfish production in this region.

Political support, including subsidies, incentive payments, and targeted extension services have stimulated the expansion of integrated rice-crayfish farming. Government investments have supported the development

Figure 3: Annual expansion of integrated rice-crayfish cultivation from 2013 to 2020



Note: The insets labeled A – D are zoom-ins of expansion hotspots

Satellite images reveal rapid spread of smallholder crayfish farming in China's rice fields

of functional supply chains to support crayfish marketing. Subsidies have supported the adoption of production technologies, and farm visits as well as demonstration events have introduced farmers to the rice-crayfish farming system. Farmers rapidly adopted crayfish farming as it is more profitable per unit area than mono-cultural rice cropping.

The impact of the COVID-19 outbreak

The rice-crayfish production boom stalled in 2020 due to the strict lockdowns aimed at containing the COVID-19 outbreak that emerged in Wuhan City. The lockdown interrupted the crayfish value chains and caused a collapse in demand. Access to production inputs, such as equipment, feed, technology and logistics became impeded during the spring of 2020, a critical season for crayfish rearing and for feeding the juvenile crayfish that had been added to the trenches in February (Figure 1). The closure of feed mills in response to the lockdowns resulted in a serious feed shortage. Moreover, the lockdown measures encompassed restrictions on people's movements, which restricted field management and access to essential production inputs during the peak period of crayfish rearing (Pu & Zhong, 2020). The strong reliance of crayfish production on functioning supply chains and the timing of the lockdown during the key period of production resulted in a stark contraction in crayfish production.

Demand for crayfish also plummeted because the limitations on mobility lowered crayfish sales to end consumers. Wuhan and neighboring cities shut down most public transportation systems and seafood markets. The closure of all restaurants further reduced the demand

for crayfish and, even after the strict lockdown measures were lifted, people visited restaurants less often than before the pandemic.

Socioecological implications of expanding the rice-crayfish system

The rice-crayfish system produces higher monetary benefits for farmers but lower crop yields compared to paddy rice monocultures. The caloric and protein yields of the integrated rice crayfish system are lower than those of the traditional rice cropping system and of rice-wheat rotation systems; the latter two produce two cereal harvests per year, whereas the rice-crayfish system produces only one rice harvest.

damage, integrated rice-crayfish farming uses an average of 17 per cent fewer pesticides and fertilizers compared to rice monocultures (Hou et al., 2020). The input of nutrients and pollutants in rice-crayfish systems stem from inputs from crayfish rearing, including feed, medication, disinfectants and pesticides. While rice plants provide sufficient fiber for crayfish, feedstuffs containing nitrogen and phosphorus need to be added for an optimal crayfish diet (Boyd & Massaut, 1999). Approximately 30 per cent of the feed will turn into solid waste which disperses into water. Nitrogen is released in the form of ammonia and then decomposes into nitrite and nitrate. The phosphorus that is not metabolized by the crayfish is released with the feces into the water cycle. Since farmers exchange the water about every ten days during the rearing period, chemicals and nutrients dissipate into natural water bodies, contributing to eutrophication. Given the considerable extent of rice-crayfish production and the prospect of further expansion, this high

nutrient loading into water bodies needs to be carefully monitored. Measures to treat nutrient waste before it is released into the environment are critical for limiting water pollution.

Aquaculture is, globally, the main route for introducing invasive crustaceans. The red swamp crayfish is an invasive species and thus poses a threat to endemic biodiversity and a functioning eco-system. In other regions where the red crayfish exists but is not native, it has attained an important position in the trophic chains of invaded environments thanks to its flexible dietary patterns that facilitate adaptation. Currently, the red crayfish has managed to establish viable populations in the wild in Central and Northern Europe, Asia, and Africa. In rice-crayfish systems in China, several measures to prevent the crayfish from escaping into the natural environment have been implemented. For example, the openings of water pipes are covered with nets or asbestos shingles to reduce the number of crayfish that escape. However, the large numbers and extent of the production units make it almost impossible to prevent crayfish from escaping, which poses a threat to the surrounding ecosystems.

Summary

Aquaculture is one of the fastest-growing food production sectors in the world. In this paper we have described the rapid rise of the integrated rice-crayfish system in China, which comprised 4 per cent (51 million tons) of total global inland seafood production in 2019. The rice-crayfish system generates a key staple crop and valuable seafood protein on the same land, exploits synergies in nutrient cycling, and balances out the year-round

peaks of farm labor. The farming system generates high monetary profits, which are expected to remain as demand for crawfish is likely to increase. In the absence of regulatory interventions, we expect the expansion of crayfish production to continue after the temporary interruption of COVID-19. However, the threats to freshwater quality through nutrient leaching and the risks to the native ecosystem from escaped crayfish loom large and need to be carefully monitored. Advancements in waste management and effective regulatory policies that reduce environmental costs are needed in order to take advantage of the benefits of the rice-crayfish farming system while reducing its environmental costs. Through such measures, the integrated rice-crayfish system can become a sustainable farming system that achieves high land productivity and nutritional benefits at comparatively low ecological costs. Promoting similar integrated aquaculture production systems in other world regions may help to improve dietary patterns in regions where seafood intake is otherwise low, such as in Africa and Latin America.

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Diagram sources and acknowledgements

Title Integrated rice-crayfish production near Quianjiang, Province Hubei © Imagery CNES / Airbus, Maxar Technologies, Map data ©2022

Fig. 1 The typical production cycle of the integrated rice-crayfish farming system © Own illustration

Fig. 2 Increase in area under integrated rice-crayfish cultivation in the five provinces studied for 2013 - 2020 © Own illustration; and representation of an adult male crayfish that can reach a length of 12 cm © Nookipedia.com (https://dodo.ac/np/images/thumb/b/b6/Crawfish_NH.png/176px-Crawfish_NH.png)

Fig. 3 Annual expansion of integrated rice-crayfish cultivation from 2013 to 2020 © Own mapping



Yanjun Ren, Yanling Peng, Bente Castro Campos and Houjian Li

**The effect of contract farming on the environmentally
sustainable production of rice in China**

The effect of contract farming on the environmentally sustainable production of rice in China

Yanjun Ren, Yanling Peng, Bente Castro Campos and Houjian Li¹

Introduction

Agricultural production is one of the largest contributors to global climate change, and this is particularly true in developing economies where agriculture still plays a significant role in economic development. In China, the overuse of chemical fertilizers and pesticides in recent decades has become a great threat to natural resources and the sustainable development of agriculture. To achieve sustainable agricultural development while simultaneously meeting the increasing demand for food, China has issued several policies to highlight the importance of environmentally sustainable production. For instance, in 2004, China released the “No. 1 Central Document” in which “three rural issues” were specifically highlighted with regard to developing modern agriculture based on low carbon emissions, recycling and ecologically friendly measures. Environmentally sustainable production becomes increasingly important in the future evolution of agriculture, targeting energy savings, consumption and pollution reductions as well as the development of high-quality, highly efficient, ecologi-

cal and safe agricultural production methods through standardized production models (Liu et al., 2020). This is particularly urgent in order to tackle changing consumption patterns, given the fact that the demand for food has switched from a focus on higher quantities to better quality (Ren et al., 2019), such as the increasing demand for green or organic food. This reflects a significant transition in the pattern of agricultural production to achieve food security and sustainable agricultural development.

As the main participants in the food value chain, farmers play a crucial role in promoting the environmentally sustainable development of agriculture. However, farmers are still not taking their own initiative to adopt environmentally sustainable production as the public’s appreciation of this form of production does not replace the economic losses farmers face when switching from conventional to organic agriculture. Farmers are often reluctant to reduce pesticide use or replace chemical fertilizers with organic ones. The prime reason is that the costs of environmentally sustainable production are

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considerably higher, even though yields are comparatively lower than in conventional production. Moreover, market uncertainty and price fluctuations put farmers at a greater risk, making them even less likely to adopt environmentally sustainable production practices. At the same time, however, organic farming has strong positive externalities.

Contract farming (CF) represents a profound institutional innovation that can modernize agricultural systems. Its potential to resolve market failures has been discussed extensively. Contract farming generally involves regulating a farmer's production through contracts with buyers through vertical integration within the value chain or other forms of coordination. These contractual arrangements integrate small-scale farmers into modern agricultural value chains, providing them with inputs, technical assistance and secure sales markets. Thus, farmers are better equipped to cope with price fluctuations and are able to reduce their transaction costs for market access. This, in turn, contributes to the efficiency of agricultural production and increases a farmer's incomes. Ideally, CF could also commit farmers to improving food quality and achieving sustainable agricultural development through a reduction in the use of chemical fertilizers and pesticides. However, it is also possible that, in practice, farmers would demonstrate opportunistic behavior, such as input diversion, side-selling and the violation of product standards due to information asymmetry, incentive incompatibility and incomplete contracts. Similar opportunistic behavior can also be observed in this principal-agent relationship on the part of agricultural and food companies through excessive contractually fixed prices for inputs and very low purchase prices for agricultural products. Given these

complexities, we aimed to discover the extent to which CF is able to encourage farmers to switch to environmentally sustainable production.

Most of the existing literature focuses exclusively on the welfare effects of CF (Bellemare and Bloem, 2018), with there being scant studies on the effects CF has on farmers favoring environmentally sustainable production practices. The most relevant study by Mishra et al. (2018) investigates the impact of CF on the production of organic basmati rice in India, but with a focus on yields, sale prices and the livelihoods of rice producers. We sought to close this research gap by rigorously investigating the causal effect of CF on rice farmers' decisions to adopt environmentally sustainable pest control technologies, manual weeding, and organic fertilizer use. We based our investigations on a survey of 623 rice farmers (334 participants and 289 non-participants) conducted in 2019 in Sichuan province (China). In addition to estimating the treatment effect of CF, we also sought to understand the channels through which CF can affect environmentally sustainable production. The economic benefits of CF are supposed to be the main channels through which CF can affect environmentally sustainable production, including the sales price, total costs as well as farmers' gross and net incomes from rice production. A brief theoretical framework is presented in **Figure 1**.

Econometric estimation techniques

To econometrically estimate the treatment effect of participating in contract farming, we first applied the propensity score matching (PSM) method to estimate the sampling bias due to observable factors. To create a comparison group to control for the treatment effect

(transition to contract farming), the PSM summarizes each farmer's pre-treatment characteristics into an index variable to then create pairs of participating and non-participating farmers according to predicted propensity scores (matching). Several methods are available to estimate the treatment effect. As in previous studies, this study used nearest neighbor matching (NNM) and radius matching (RM).

Subsequently, the econometric estimation was extended using endogenous switching regression (ESR) as a robustness check. This allowed us to estimate potential sampling biases due to both observable and unobservable factors. The ESR model has two stages. The first stage involves identifying the motivations behind the farmers' decision to participate in contract farming. Using the results of the first stage, the equations estimated in the second stage are used to analyze the factors that influence the farmers' transition to environmentally sustainable farming practices. To correctly identify the model, the time required to reach the nearest agribusiness enterprise was used as a potential instrument variable for participation in contract farming, as is common in such studies.

Sample and data

The econometric study is based on data from a post-harvest survey of rice farmer households in Sichuan province which was conducted in August and September 2019. This region was chosen as one of the most important rice-growing areas in China. According to official statistics, Sichuan Province produces a total of about 15 million tons of rice annually. This represents about 7 per cent of China's total annual production (National

Bureau of Statistics of China, 2021). We selected seven prefecture-level cities or autonomous prefectures in the major rice-producing areas: Chengdu, Deyang, Bazhong, Dazhou, Yibin, Luzhou and Liangshan (see **Figure 2**). The first step was to select one or two counties in each prefecture or autonomous prefecture that had a high density of registered agribusinesses. Then, one or two smaller townships were identified in each county. Trained graduate and senior undergraduate students conducted the face-to-face household interviews. A total of 641 questionnaires were completed, of which 623 from 52 villages were included in the study. Not all surveys could be used because, in some cases, information on important variables was missing or there were outliers.

The term contract farming generally refers to an agreement between farmers and agribusiness companies, based on which agreed quantities of a given product are to be delivered at a given time at specified quality standards, in return for which the company commits to a fixed price (FAO, 2017). In this study, contract farming is defined by the following question: "Has the farm household signed a contract for rice production with relevant economic organizations (leading enterprises, specialized cooperatives, family farms, etc.) with the purpose of selling rice?" If the answer is "yes", the farm in question is considered to be involved in contract farming, otherwise it is not. **Table 1** shows that 334 of the 623 farms, or 53.6 per cent, participated in contract farming.

Indicators of the farmers' use of environmentally sustainable farming practices include the use of sustainable pest control practices, manual weed removal, and the use of organic fertilizer. Table 1 presents the descriptive statistics of the variables related to these practices. According to the sample, a large number of farmers used

Figure 1: Mechanisms through which contract farming works toward ecologically sustainable forms of cultivation

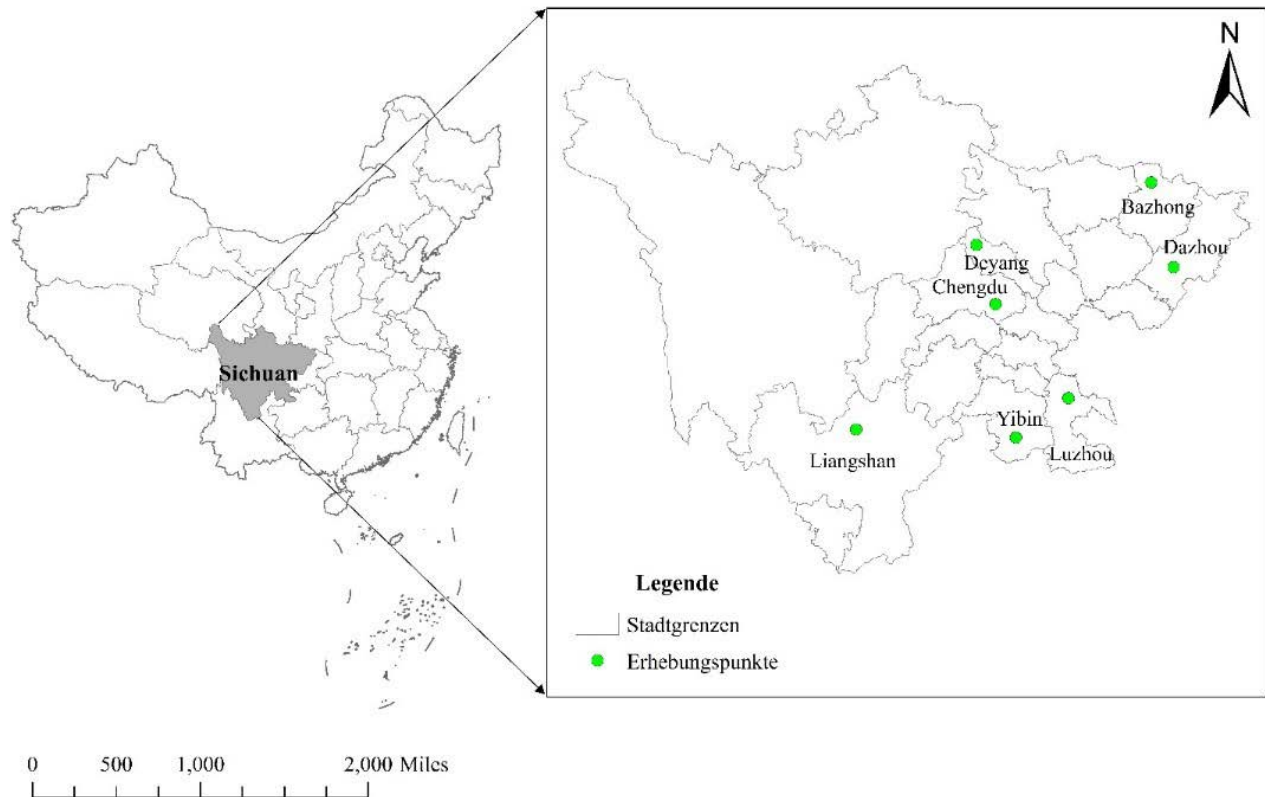


ecologically sustainable practices for pest control (65.7 per cent), but only 18.1 per cent of the farmers surveyed removed weeds manually. On average, about 119 yuan per mu was spent on organic fertilizers (one mu equals 0.067 hectares).

Sales price, total costs, revenue and net profit were four key economic ratios selected as variables reflecting the effect of participation in contract farming on ecologically sustainable cultivation. As shown in Table 1, the average sales price of rice was 6.473 yuan per kilogram, the total cost of cultivation per mu was about 1,659 yuan, while the revenue and net profit from rice cultivation were 2,156 and 502 yuan per mu respectively. Clear differences were observed between contract and non-con-

tract farmers in terms of the economic profitability of rice cultivation or the income that can be earned; farmers involved in contract cultivation performed much better economically (see **Table 2**). For example, farmers participating in contract farming achieved an average sales price of 3.870 yuan, which was higher than non-participating farmers, and generated a higher revenue of 1,823 yuan on average and a higher profit of 168 yuan per mu. However, farmers participating in contract farming incurred higher costs for rice cultivation (additional costs of 1,660 yuan/mu) compared to non-participating farmers.

Figure 2: Regions in Sichuan Province where rice farmers were surveyed



Conclusion and discussion

It can be concluded that participation in contract farming is associated with significant positive effects in terms of the use of ecologically sustainable pest control practices, manual weed removal, and organic fertilizer use. The re-

sults are consistent when both PSM and ERS econometric procedures are used. More specifically, the likelihood of farmers adopting ecologically sustainable pest control practices, manual weed removal, and organic fertilizer

Table 1: Descriptive statistics of the main variables

		Pooled	
Variables	Definition	Mean	SD
<i>Treatment</i>			
Contract farming	1 if the household participated in contract farming, otherwise 0	0.536	0.499
<i>Environmentally sustainable production</i>			
Pest control technologies	1 if the household adopted environmentally sustainable control technologies, otherwise 0	0.657	0.475
Manual weeding	1 if the household adopted manual weeding, otherwise 0	0.181	0.386
Organic fertilizer	Expenditure on organic fertilizer (thousand yuan/mu ^a)	0.119	0.069
<i>Channel variables</i>			
Sales price	Sales price of rice per kilogram (yuan/kg)	6.473	6.463
Total costs ^b	Total cost of rice production (thousand yuan/mu)	1.659	1.485
Gross income	Gross income from rice production (thousand yuan/mu)	2.156	1.581
Net income	Net income from rice production (thousand yuan/mu)	0.502	0.336

^a One yuan was equal to 0.14 US dollars in February 2020; one mu is equal to 0.067 hectares.

^b Total costs include the cost of labor, seeds, fertilizers, pesticides, irrigation water, etc.

use could be improved by 57.2 per cent, 27.6 per cent, and 31.9 per cent respectively if all farmers participated in contract farming. An important finding is that contract farming has been observed as having a positive impact on environmental sustainability through economic benefits to farmers in terms of their sales prices, revenues and profits, even though farmers must invest more heavily in rice cultivation. It can be concluded that contract farming can be used as an important practical measure to accelerate the spread of environmentally sustainable practices in rice production. Accordingly, agricultural policy should consider promoting contract farming for sustainability-oriented agricultural development. Agri-

business companies should close the gaps in their control systems to prevent contract violations. This would allow the benefits of contract farming to be leveraged to achieve the goal of sustainable agricultural development without compromising the farmer's welfare.

Our results draw important conclusions both from a practical farming and an agricultural policy perspective. While ecologically sustainable farming is environmentally friendly, farmers who grow rice in an ecologically sustainable manner face higher costs and higher labor in addition to the risks associated with market uncertainties, plant diseases and pest infestations. If contract farming effectively hedges farmers against price volatili-

Table 2: Differences between farmers participating in contract farming and non-participating farmers in key variables

	Participants		Non-Participants		
Variables	Mean	SD	Mean	SD	Difference
<i>Environmentally sustainable production</i>					
Pest control technologies	0.919	0.273	0.353	0.479	0.566***
Manual weeding	0.272	0.446	0.076	0.266	0.196***
Organic fertilizer	0.143	0.060	0.090	0.067	0.053***
<i>Channel variables</i>					
Sales price	5.067	3.653	1.197	0.214	3.870***
Total costs	2.429	0.091	0.769	0.019	1.660***
Gross income	3.000	1.742	1.178	0.319	1.823***
Net income	0.580	0.418	0.412	0.163	0.168***

***, ** and * denote significance at the 1% level, 5% level and 10% level, respectively.

ty and helps to ensure the quality of their produce (Guo et al., 2007; Maertens and Vande Velde, 2017), it can be considered a very effective means of improving farmers' incomes and increasing their welfare (Bellemare and Bloem, 2018). It would enable farmers to compensate for obstacles, such as lower yields, that hinder their increased engagement in environmentally sustainable farming. Because faithful contract performance can be analyzed in game theory terms as a dynamic game between farmers and agribusinesses, the dynamic influence of contract farming on ecologically sustainable practices over time should also be the subject of future research, as this would be the only way to better assess the short-term and long-term impacts of contract farming. This study focuses on the impact of contract farming on ecologically sustainable practices in rice production, therefore, the results presented here should be interpreted with due caution. Further research is needed to assess the multi-

faceted influence of contract farming on different agricultural products, insofar as they involve quite different inputs and outputs, which in turn could have different effects on farmers' production practices. In addition, the relationship between contract farming and ecologically sustainable agriculture should be investigated from the perspective of behavioral economics, for example, in terms of attenuated risk perception and farmers' time preference.

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Diagram sources and acknowledgements

Title Aerial top view of Farmer using digital Tablet in a green rice field, View from above shot by drone © Naypong Studio – stock.adobe.com

Fig. 1 Mechanisms through which contract farming works toward ecologically sustainable forms of cultivation © Own compilation

Fig. 2 Regions in Sichuan Province where rice farmers were surveyed © Own compilation

Tab. 1 Descriptive statistics of the main variables © The calculations are based on the authors' rural household survey conducted in August and September 2019; the pooled sample includes 623 households.

Tab. 2 Differences between farmers participating in contract farming and non-participating farmers in key variables © Own compilation





Zafar Kurbanov, Abdusame Tadjiev and Nodir Djanibekov

Adoption of sustainable agricultural practices and investments in productive assets in irrigated areas of Central Asia: farm-survey evidence from Kazakhstan and Uzbekistan

Adoption of sustainable agricultural practices and investments in productive assets in irrigated areas of Central Asia: farm-survey evidence from Kazakhstan and Uzbekistan

Zafar Kurbanov, Abdusame Tadjiev and Nodir Djanibekov

Contrasting institutional pathways

Farmers simultaneously face and manage multiple risks and constraints, ranging from weather-caused droughts, to market price volatility, unexpected changes in policies, and credit constraints - all of which affect farm operations (Komarek, 2020). Investment decisions that improve operational sustainability and increase productivity largely depend on the ability of the relevant institutional environment to limit the associated risks and constraints. Acemoglu and Johnson (2005) show that property rights are a critical determinant of long-term growth, investment and financial development. However, tenure security alone is not enough to prompt farmers to make costly long-term investments. Improved access to agricultural credit markets seems to matter more (Bromley, 2008). Together with access to land and credit, availability of extension services enables farmers to obtain the necessary information about and training in existing land conservation practices and productive assets. Agricultural policies can be liberal or dirigiste and thus determine the extent to which decision-making au-

thority is transferred to farmers (Pyysiäinen et al., 2017). Thus, the question arises whether different investment behavior occurs under diametrically opposed agricultural policy frameworks. This study attempts to answer this question by focusing on the comparative analysis of selected institutions, namely land tenure rights, extension services and credit availability in irrigated areas of Kazakhstan and Uzbekistan. Both countries have followed opposing agricultural policy approaches since 1991. These fundamentally different approaches to agricultural policy have led Kazakh and Uzbek farmers to perceive their land rights differently (Akhmadieva and Herzfeld, 2021). These contrasting agricultural policy approaches are also manifested in the degree to which the government provides complementary extension and training services and ensures access to capital (Shtaltovna and Hornidge, 2014).

In this study, we use primary data collected from farms in the AGRICHANGE project.¹ The surveys were conducted in the spring of 2019 in two regions with very

1 Institutional change in land and labor relations of Central Asia's irrigated agriculture (AGRICHANGE) www.iamo.de/en/agrichange.

different institutional settings, namely the Turkestan region of Kazakhstan and the Samarkand region of Uzbekistan. A total of 963 farm managers were interviewed, 503 from Turkestan and 460 from Samarkand.

Table 1 provides an overview of selected structural characteristics of agriculture in both study areas. Cotton cultivation and irrigated farming have traditionally been the backbone of agricultural production in both regions. However, the Kazakh government has implemented more liberal, market-oriented reforms than the government of Uzbekistan. Thus, what was once collective farmland was distributed to individual farmers. Commercial agriculture increasingly took place within the framework of small-scale farm structures, with state agencies largely

withdrawing from managing individual farms (Petrick et al., 2017). In contrast, the Uzbek government took a centralized, top-down approach to managing agricultural production through a notorious delivery quota system that, until President Shavkat Mirziyoyev's recent agricultural reforms, was similar to the planned economy of the former Soviet Union (Djanibekov et al., 2020). This included government control of the input supply to farmers, credit, and agricultural extension, with preference given to cotton and wheat producers. The Uzbek government's pursuit of an "optimal" farm size resulted in an erratic approach to farm restructuring measures, as farm mergers followed the uncoordinated fragmentation of farm ownership (Zorya et al., 2019).

Table 1: Overview of selected agro-structural characteristics of the two study regions

Feature	Turkistan (Kazakhstan)	Samarkand (Uzbekistan)
Land tenure	Long-term leases of state-owned land, private ownership of land possible, very secure tenure through leases and ownership	Long-term leases, but very insecure tenure due to state-imposed 'farm optimization' through a 'cluster policy' (creation of private but still state-regulated production clusters e.g., in the cotton sector)
Land distribution	Farmland was allocated to former members of agricultural enterprises (mainly collective farms)	Land allocation through auctions, taking into account the professional skills, education and wealth of applicants
Average farm size	About 17 ha for cotton cultivation, about 11 ha for other types of cultivation	About 49 ha for cotton cultivation, about 18 ha for other types of cultivation
Strategic orientation of agriculture	Agricultural production under market economy conditions	Until 2019/20, cotton and wheat were strategic crops under a state quota system, recent transition to private 'clusters'
Access to capital and inputs	Private banks, subsidized loans, supply of inputs such as cotton gins via contract farming	State banking monopoly, state-controlled input supply. Since 2019/20, farmers receive supplies based on contracts with regional 'clusters'
Provision of agricultural extension	KazAgro Innovation, processors through contract farming	Public universities and research institutes. Since 2019/20, additional services within private 'clusters'

Recognizing the need for reform to develop a competitive, market- and export-oriented agriculture, the Uzbek government adopted its Agri-Food Development Strategy 2020-2030 and initiated fundamental transformations. Among other things, the strategy aims to develop diversified agricultural production and increase exports by encouraging private investment and establishing secure property rights over land.

The comparative account presented here expands our idea of what is possible in such a market-oriented transformation and what needs to be considered. First, it seeks to compare the behavior of the farmers interviewed with respect to their use of sustainable agricultural practices (SAP) as well as their farm investments under the contrasting frameworks described above. Even though other factors such as legal institutions, procurement and sales markets, and infrastructural conditions, to name a few, may have at least as much influence on farmers' investment decisions, the focus here will be on three specific institutional factors, namely tenure, complementary extension and training services, and credit availability.

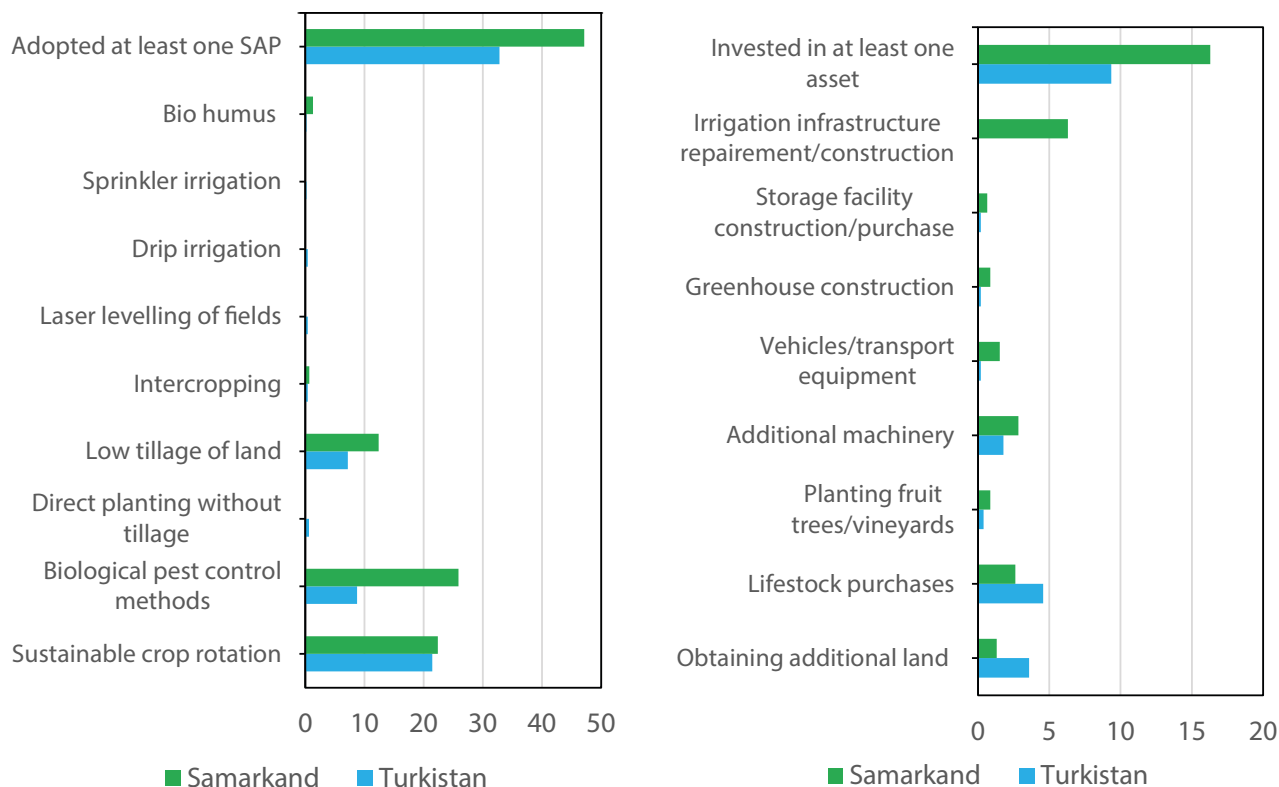
Similar survey results

In 2018, there were no major differences in the use of sustainable agricultural practices (SAP) and investment behavior between the two regions (**Figure 1**). Although farmers in Kazakhstan's Turkestan region were able to operate in a more liberal environment, both the Kazakh and Uzbek survey respondents' use of sustainable agricultural practices and on-farm investments resulted in nearly identical survey scores. Overall, about one-third of Kazakh farmers surveyed and about half of Uzbek farm-

ers surveyed used at least one sustainable agricultural practice. Crop rotation, biological pest control, and conservation tillage, i.e., low-cost sustainable agricultural practices, were the sustainable agricultural practices that were the most prevalent among the Kazakh and Uzbek survey respondents. Crop rotation, a sustainable farming practice traditionally rooted in local cotton production, was equally popular among Kazakh and Uzbek farmers. However, biological pest control and conservation tillage before sowing were more common among Uzbek farmers than Kazakh farmers. In both regions, survey respondents proved very reluctant in adopting the more costly sustainable agricultural practices such as water-saving irrigation techniques and laser leveling, which Central Asian farmers could admittedly use to better address problems such as water scarcity and soil degradation.

In terms of farm investments, a total of 9 per cent of Kazakh farmers and 16 per cent of Uzbek farmers reported investing in at least one category of farm assets in 2018 (Figure 1). Uzbek survey respondents invested more in irrigation infrastructure than their counterparts in Kazakhstan. Otherwise, survey results were similar in both regions. In Kazakhstan, farmers preferred investing in livestock and acquiring additional land. Ultimately, only a small proportion of farmers in both countries invested in other types of farm assets. These included, in descending order: additional machinery, transport equipment, fruit trees, greenhouses and storage facilities.

Figure 1: Use of sustainable agricultural practices (left) and operational investments (right) among Kazakh and Uzbek farmers, in per cent of respondents

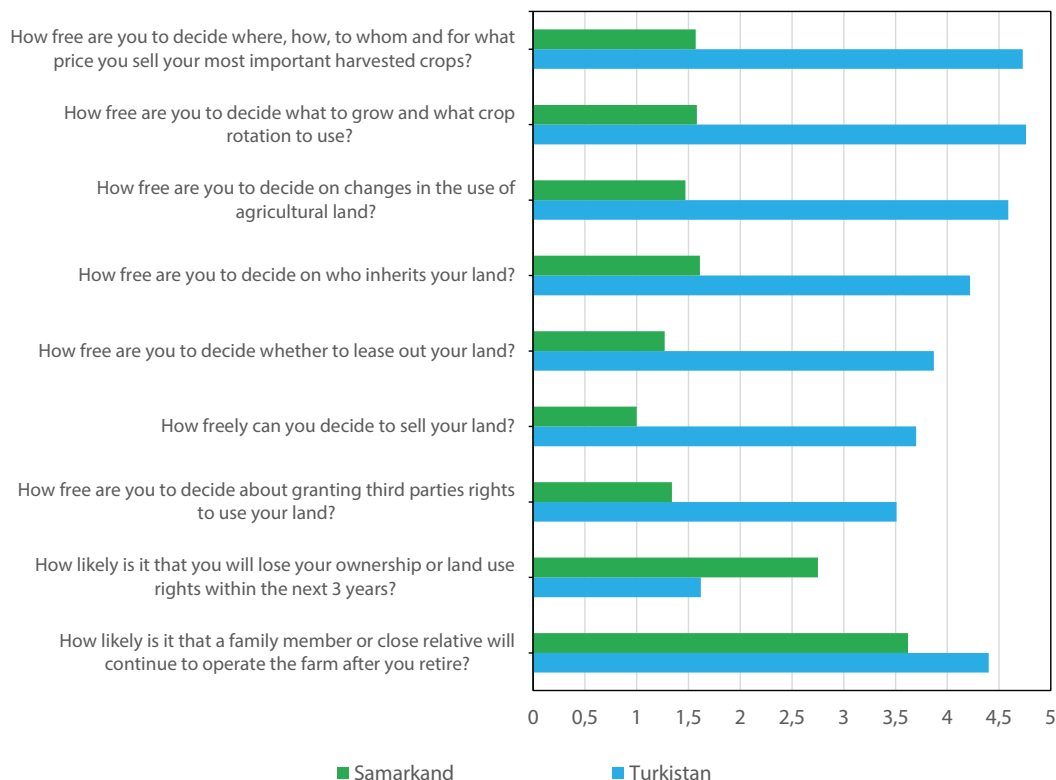


Perceived land tenure rights

Figure 2 shows the responses of Kazakh and Uzbek farmers to questions about how they perceive their tenure security, their free disposal of land, and their freedom to make farm management decisions. There are significant differences between the agricultural producers in the two countries as reflected in the farmers' self-perceived

tenure rights. Perceived certainty about the continued existence of their land use rights is significantly stronger among Kazakh farmers. They have a higher degree of certainty that they will not lose their land and that their farm will remain in the hands of their family in the future.

Figure 2: Perceptions about land tenure rights among Kazakh and Uzbek farmers, in per cent of respondents



Note: The lower two questions range from '1-Extremely unlikely' to '5-Extremely likely'. The remaining questions range from '1-It is impossible' to '5-It is fully my decision'.

There is also greater certainty among Kazakh farmers than among Uzbek survey participants regarding the free disposal of their land, for example, through leasing, sale, or the granting of rights of use. In addition, Kazakh farmers expressed their certainty that they can put their land to other agricultural use at their discretion as well as bequeath it. As expected, since the government can intervene and terminate current leases at any time, some-

thing that occurred in the past as part of state programs to consolidate agricultural enterprises, any possibility of free disposal of their land seems extremely unrealistic to Uzbek farmers. The constant threat of possible expropriation, against which farmers have no rights of appeal, threatens the future of farms. Thus, Uzbek farmers have grave doubts about their ability to realize the future benefits of sustainable practices and investments. In addi-

tion, Uzbek survey respondents felt severely restricted in their freedom to choose the crop and distribution channels for their produce, particularly if they specialized in cotton and wheat production.

Sources of information and training

A comparison of the respondents' information on training in the last three years shows that Uzbek farmers have participated in more training than Kazakh farmers (**Figure 3**, left side). Overall, Kazakh survey respondents indicated a low participation in training. However, the majority of the Uzbek farmers' training was limited to cotton and wheat production, Uzbekistan's two strategic agricultural products. Only 7 per cent of Uzbek farmers indicated that they had received training in fruit and vegetable production, i.e., in the production of those high-value agricultural products that the Uzbek government particularly wants to promote as part of its strategy for developing the agricultural and food economy.

The agricultural information on which farmers relied varied (**Figure 3**, right-hand side). Kazakh farmers obtained their technical information primarily from the Internet and the media. In contrast, among Uzbek farmers, the state administration and the farmers' association were still the most important sources of technical information. According to the survey respondents, the private sphere, i.e. relatives, neighbors and other farmers, was the most important sources of information in both regions. A large proportion of respondents in both regions obtained information online and from the media to confirm and supplement information obtained from the private sphere and from the government. The important role the Internet and media played as sources of

information is not surprising, given the increasing use of mobile Internet in both countries.

Access to agricultural credits

State policy in both countries is to use the bulk of the agricultural credit to finance production, i.e., to buy seeds, fertilizers and fuel. Despite gradual reforms, the agricultural credit sector in Uzbekistan remains centralized and state-controlled: Loans are extended by certain banks to agribusinesses (more recently to "clusters") primarily for cotton and wheat production. Table 2 shows the borrowing behavior of farmers surveyed in Kazakhstan and Uzbekistan. The percentage of Kazakh and Uzbek farmers who borrowed money in 2018 is nearly equal. The main factor that can be used to explain farmers' borrowing in Uzbekistan and Kazakhstan is the effective demand for credit, which is low due to low and uncertain revenues from agricultural production (Petrick et al., 2017). Limited borrowing due to price and risk rationing among the surveyed farmers may be evidence that survey respondents believe that investments in agriculture cannot sufficiently generate stable returns to repay the loans. Only a relatively small proportion of respondents believe that lack of access to credit is the main reason for not taking out a loan.

Figure 3: Training content (left) and sources of information (right) among Kazakh and Uzbek farmers, in per cent of respondents.

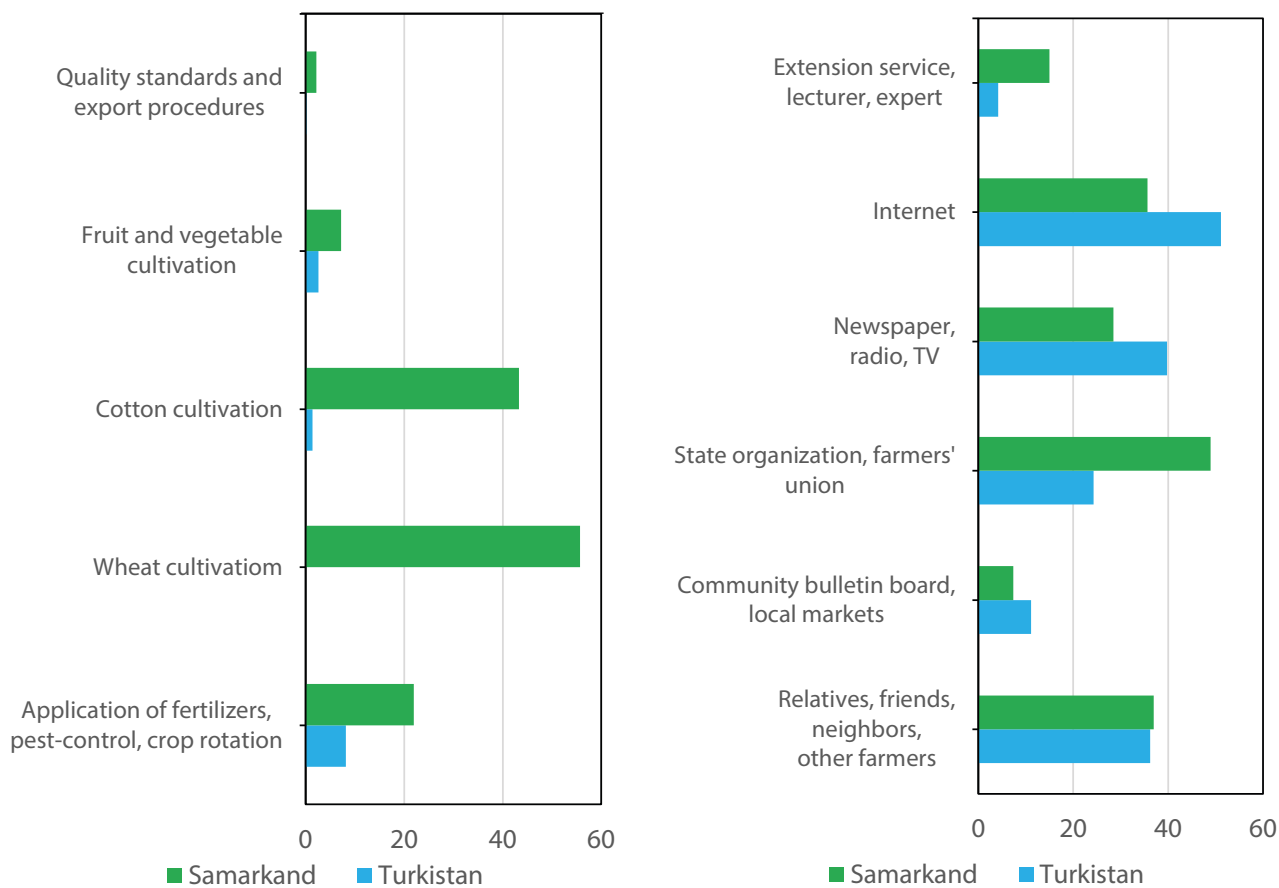


Table 2: Kazakh and Uzbek farmers' information on credit rationing, in per cent of respondents

Indicator	Kazakhstan	Uzbekistan
Borrowing in 2018	27.6	28.3
Price-rationed borrower	10.9	12.6
Quantity-rationed borrower	16.7	15.7
No new borrowing in 2018	72.4	71.7
Price-rationed non-borrower	66.0	50.9
Quantity-rationed non-borrower	2.4	7.0
Risk rationed non-borrower	2.2	10.7
Transaction cost-rationed non-borrower	1.8	3.3

Note: To analyze farmers' access to credit, we used the method of directly asking respondents about their individual borrowing status according to Petrick et al. (2017)

Conclusions

The expectation that a more liberal environment, in which independent decision-makers take full responsibility for farm management, will lead to different farm decisions and developments than a dirigiste environment is not borne out by our data. Kazakh farmers tended to use cost-intensive sustainable agricultural practices (SAP) less frequently under more liberal conditions. A similar trend can be observed in dirigiste Uzbekistan with its top-down approach, although here the use of biological control practices played a slightly larger role due to government involvement in providing technical information and offering training for cotton cultivation. A similar picture emerges for on-farm investments made by only a small proportion of farmers. A comparative analysis of both countries suggests that in both more liberal and dirigiste environments, farmers' opportunities to benefit from productivity-enhancing but costly

sustainable agricultural practices and investments were constrained due to limited access to agricultural credit. It can be argued that, in addition to limited access to credit, tenure insecurity and government intervention in farms hindered the use of sustainable agricultural practices and investments among Uzbek farmers. In addition, private information services for agribusinesses still need to be expanded in both countries. Many farmers still rely heavily on personal advice from those around them. In Uzbekistan, government extension services provide technical information to farmers, but this is largely limited to the cultivation of strategic agricultural products. In Kazakhstan, farmers rarely participate in training and largely obtain their technical information from the Internet and media.

Thus, it can be concluded that sustainable agricultural practices and farm investment is likely to be difficult to promote unless the severe credit constraints can be reduced, even if other institutional conditions improve.

For Uzbekistan, which is just beginning the process of modernizing its agriculture, the lesson to be learned from the survey regarding the use of sustainable agricultural practices is that secure land rights alone do not sufficiently guarantee the development of sustainable agriculture and increased farm investment. The same is true for farm investments in neighboring Kazakhstan. In addition to secure property rights and sufficient agricultural expansion, the promotion of investment is fundamental to increasing the use of sustainable agricultural practices and increasing farm investment so that sustainable and environmentally friendly agriculture can flourish in Central Asia.

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Diagram sources and acknowledgements

- Title** Uzbek farmer operating small-scale potato harvester
© Abdusame Tadjiev
- Tab. 1** Overview of selected agro-structural characteristics of the two study regions © Extended table based on Table 1 in Amirova et al. (2019))
- Fig. 1** Use of sustainable agricultural practices (left) and operational investments (right) among Kazakh and Uzbek farmers, in per cent of respondents. © IAMO, Project AGRICHANGE
- Fig. 2** Perceptions about land tenure rights among Kazakh and Uzbek farmers, in per cent of respondents © IAMO, Project AGRICHANGE
- Fig. 3** Training content (left) and sources of information (right) among Kazakh and Uzbek farmers, in per cent of respondents © IAMO, Project AGRICHANGE
- Tab. 2** Kazakh and Uzbek farmers' information on credit rationing, in per cent of respondents © IAMO, Project AGRICHANGE





Anna Hajdu and Taras Gagalyuk

**Corporate social responsibility in the
agricultural sector of Eastern Europe and Central Asia
Romania, Ukraine, Russia and Kazakhstan in focus**

Corporate social responsibility in the agricultural sector of Eastern Europe and Central Asia

Romania, Ukraine, Russia and Kazakhstan in focus

Anna Hajdu and Taras Gagalyuk

Introduction

Corporate social responsibility (CSR) is generally defined as a set of measures and activities that companies utilize in order to contribute to the common good or to limit the negative consequences their activities have for society. CSR manifests itself not only in organizationally underpinned strategies and policies, but also in specific activities within a certain context. With the exception of a few general studies on the food industry, little research has been conducted at farm level on CSR activities in the agricultural sector. This is particularly true in the former socialist countries of Eastern Europe and Central Asia. Only recently have some scientific studies taken a closer look at the CSR activities of large-scale agricultural enterprises in Russia and Ukraine (Gagalyuk et al., 2018; Visser et al. 2019; Bavorova et al. 2021).

These studies show that, even three decades after the demise of the planned economy, agricultural enterprises in the transition countries of Eastern Europe and Central Asia still have to operate in a very uncertain, relatively unpredictable institutional environment where there is an immense need for reform (Gagalyuk and Valentinov 2019). This lack of institutional reliability and predictability sets these countries substantially apart from

Western economies, which are characterized as having more stable institutions. These fundamental institutional deficiencies are revealed by the absence of effective governance mechanisms, a functioning legal system and market, as well as a weak civil society. This institutional vacuum leads to a societal expectation that agribusinesses should act in a socially responsible manner. At the same time, little is known about whether agribusinesses have what it takes to meet expectations under a rapidly changing institutional environment. This article presents recent findings on the CSR measures of agricultural enterprises under the institutional conditions of the transition economies of Eastern Europe and Central Asia. These findings help answer the question of how the actors' motivations and the pressures they face from their CSR activities are reflected in their actions.

It is important to point out that, in the countries of the former Soviet Union, large collective farms played a central role in the lives of the rural population. These collective farms guaranteed employment, supported the vital subsistence agriculture of their members or labor force, ensured the availability of sufficient inputs such as fertilizers, seeds and machinery, and provided social ser-

vices and infrastructure. The collective farms (kolkhozes) and state farms (sovkhozes) thus took on genuine state or public responsibilities, especially in providing social security for the rural population and supplying it with public goods. With the end of the Soviet Union and the rapid disintegration of the planned economic system, these agricultural enterprises were no longer obliged to fulfill their social tasks.

At the same time, new effective governance structures and strong institutions were needed due to an extremely uncertain institutional framework, the elimination (without replacement) of central social security institutions, and the lack of infrastructure provision, all linked to the agricultural enterprises. For example, general rural development problems, such as unemployment, an aging rural population, poverty, the lack of educational institutions and inadequate medical care, have worsened over the past decade. Moreover, at farm level, agricultural enterprises themselves are victims of unstable institutional frameworks, which manifest themselves in poorly functioning markets for production factors such as land, capital and labor.

Given our patchy knowledge of CSR activities in the agricultural sector, especially in Eastern Europe and Central Asia, this paper provides an overview of our research findings on CSR activities in agribusinesses in Romania, Ukraine, Russia and Kazakhstan. Special attention is paid to the drivers and impacts of CSR activities in the agricultural sector, and to how they interact with country-specific institutional conditions and developments.

The results for Romania are based on a qualitative survey of interviews conducted with 24 agribusiness managers and nine key information providers from the agricultural sector. In Ukraine, four of the large ag-

ricultural enterprises, referred to as agroholdings, were included as case studies in the survey. For Russia and Kazakhstan, the results are based on a survey involving more than 800 farms. Our analysis moved within a spectrum of weakly to fully developed markets on the one hand, and barely existing to fully developed governance and civil society on the other.

CSR activities in the Romanian agricultural sector

Our results show a moderate level of CSR commitment on the part of the agricultural companies in Romania. Measured against the claim that CSR promotes the common good and is intended to limit the negative consequences the agricultural companies' activities have for society, these CSR measures tend to be more symbolic and of a philanthropic nature, for example providing support to churches, donating products, and sponsoring events and celebrations. Some managers of large farms, most of which are on leased land, demonstrate leadership qualities and a strong sense of responsibility when they support their employees and their landlords/landowners by providing quick and straightforward assistance when problems arise. Admittedly, these activities only affect the companies' immediate environment and do not generate any social benefits beyond that. In addition, the measures often have a symbolic character and a political background. They arise more from a political interest than from a genuine sense of responsibility.

Some agricultural enterprises demonstrate social responsibility by providing services that should actually be provided by the state. One farm stated that it removes waste in the village that has been dumped on pastureland. Other farms invest in the local transport infrastruc-

ture and in canals or agricultural access roads. Some companies only demonstrate a moderate commitment to CSR due to their desire to avoid exposure. Given the widespread corruption, these companies do not want to expose themselves to sabotage by the state and elites concerned with maintaining the status quo and defending their positions of power. For this reason, these companies, whose commitment incidentally goes beyond that of other agribusinesses (e.g., financial support for hospitals), do not go public with their CSR measures in a big way. In Romania's social and political climate, which is rife with serious corruption, a company's CSR activities can quickly be misinterpreted as a lack of social responsibility or as attempted bribery. Finally, the weak ties between the company, the authorities and the farmers, as well as between the owners of the farmland and the managers of the agricultural enterprises, are compounded by the fact that there is a great deal of mistrust among the villagers. In this difficult context of pervasive mutual distrust, agricultural companies are reluctant to engage in CSR activities. Representatives of one agricultural company have expressed the view that CSR is a communist principle, distinguishing between ensuring a "decent income" for employees and providing water, which in turn is the responsibility of the state. Despite a few exceptions, agricultural companies in Romania generally show only a weak commitment to CSR.

The existing mistrust with regard to the intentions pursued by companies reflects the lack of social pressure on agricultural companies to act in a socially responsible manner. There is no pressure from civil society to encourage companies to take CSR measures. When it comes to CSR activities, there is also no pressure from (semi-)private, business-related institutions such as chambers of

commerce or associations, nor from non-governmental organizations.

CSR activities in the Ukrainian agricultural sector

Ukrainian agriculture is organized on a highly corporate basis. So-called agroholdings are large agricultural and food companies that often cover the entire value chain. They control a large proportion of the land under cultivation as well as the sales markets for agricultural products. These large agroholdings demonstrate, in particular, a broad level of CSR engagement. The results of the case studies conducted in Ukraine show a strong formalization of CSR activities among agroholdings, including the planning and development of CSR budgets and programs. The CSR programs of agroholdings generally focus on rural infrastructure development, land tenant support, and employee support (including professional training).

Rural infrastructure development includes, among other things, support for schools, kindergartens and medical facilities; the repair of farm roads, powerlines and water supply facilities; as well as financial and material support for local sports and cultural associations. Under the second type of CSR, agroholdings help their landlords, often former collective farm members by paying rent in advance, providing machinery and inputs for working in their own vegetable gardens, and providing medical assistance and loans if urgently needed. The third type of CSR includes employee relations and extra benefits granted to employees. For example, employees of agroholdings can ask their employer for urgent medical or financial assistance. Another important area in which the agroholdings are involved is the training

of their employees, for which various training programs and curricula have been developed in collaboration with colleges and universities.

The CSR engagement of Ukrainian agroholdings primarily serves to address existing inadequacies of factor markets for land, labor and capital. In this regard, the main driver behind CSR activities is the need to tie landowners to a large-scale agricultural enterprise. Since the sale of arable land was prohibited in Ukraine until recently, leasing is still the only way to gain access to cultivated land. For this reason, long-term investments are tied to uncertainty for companies with leased land. This is because many landlords/owners can terminate their leases at any time as soon as they receive a better offer from a competitor.

With regard to the labor market, the agroholdings' CSR commitment is aimed at countering the problems associated with a virtually non-existent public social security system and a lack of skilled workers for their own operations. In addition, agroholdings' CSR programs include sophisticated public relation strategies to ensure public awareness of the companies' socially responsible actions. Explicitly formulated CSR strategies and detailed CSR reporting help agroholdings build and maintain a positive image and thus to attract outside capital.

CSR activities in the Russian and Kazakh agricultural sectors

The results of both the surveys conducted in Russia and Kazakhstan show that the likelihood of an agricultural company engaging in CSR activities increases with farm size. Farms that are tenants or owners of larger areas of land are more likely to engage in CSR activities. Pre-

vious research has documented that tenancy in transition countries is a factor that favors CSR measures as a means of cementing the insecure relationships between large farms dependent on rented land and landowners. Recently it has been found that a farm will more likely implement CSR measures if it owns the land. On the one hand, this finding suggests that the firm's integration into the local community, solidified by ownership, has a potentially positive effect on corporate social actions. On the other hand, just like tenants, businesses that own land may be concerned about losing the land due to insecure property rights. Similarly, it can be observed that an agricultural enterprise's CSR commitment tends to be greater when it is associated with an agroholding company.

At market level, our results show that a weak legal system is not perceived by companies as an important motivation behind CSR engagement. Instead, CSR measures that support rural infrastructure appear to be a means of addressing uncertainties at the local level, particularly those related to the risk of land loss due to unestablished property rights, dependence on the local labor market, and limited access to credit. Agribusinesses tend to engage in CSR activities regardless of the inadequacies of the overarching institutional framework. Instead, agribusinesses prefer (or are forced) to address the local implications of these general deficiencies, i.e., skill shortages, problems accessing credit, and a power imbalance in the land market in favor of large agroholdings, local authorities and landlords. These problems appear to be of such magnitude that farmers of different ages, genders and educational levels are struggling to solve them.

Discussion

Our results generally show that the motivation for engaging in CSR activities lies in a weakly developed institutional environment and is primarily purpose-driven or a reaction to dysfunctional markets. Due to existing bottlenecks and constraints, certain market transactions are often costly, if not impossible (Gagalyuk and Valentinov, 2019).

On the one hand, transition economies are characterized by poorly functioning institutions with an inadequate protection of property rights and insufficient monitoring of the actions of private companies by the state and nongovernmental organizations (Gagalyuk et al., 2021). On the other hand, public institutions are widely perceived as being captured by private interest groups and subject to politically motivated influence and corruption. Through their interactions, all these factors lead to an uncertain institutional environment in which companies try to respond by engaging in CSR activities.

For Romania, the most salient finding is that, regardless of farmers' divergent opinions on the challenges and obstacles of their day-to-day business, the capture of state institutions by private individuals is a common theme perceived as being a serious problem. Positions in schools and municipal administrations are awarded based on purely political criteria. There is widespread nepotism and the low qualifications of politicians and state officials are signs of widespread clientelism and rampant corruption. Such an environment does not encourage a company to reflect on societal issues common to all and on taking corporate responsibility for the consequences of its actions. Cultural patterns that have evolved historically have contributed to the reproduc-

tion of "captured institutions". These cultural imprints have led to deep-seated mental patterns that prevent personal initiative for solving problems that affect everyone, and thus prevent effective CSR engagement. The CSR activities that are actually implemented are based on spontaneous desires and are the result of specific influences. However, subjective preferences and cultural inclinations are not aligned with the actual needs of the general public.

The institutional frameworks existing in Ukraine, Russia and Kazakhstan, e.g., for land use, human capital development and technological adaptation, have a significant impact not only on economic returns but also on the social benefits of large-scale agriculture. Given the inadequacy of the social security systems, agricultural enterprises in these countries are searching for ways to provide social security beyond simply adapting to the existing deficient institutional environment. In particular, companies are seeking to proactively address existing imbalances insofar as they affect their business. At the same time, agricultural companies may themselves be part of the problem. Political actors are rarely subject to effective checks and balances, and capture of the state by large agricultural companies is possible.

Based on the available evidence, large agroholdings in Ukraine, Russia, and Kazakhstan are actively engaged in CSR activities, but these findings do not allow us to draw conclusions about the extent to which this is "greenwashing". Instead, our findings on these countries suggest that deficient institutions lead agroholdings, as well as other types of agribusinesses, to implement CSR measures regardless of the degree to which they are affected by the problem of private capture of public institutions.

Like any survey, the present study has its limitations. In Romania, only farms from three regions were considered and respondents were limited to the senior managers of farms or other agriculture-related sectors. Future studies should include more regions, and opinions should be gathered from farm employees, the rural population and value chain stakeholders in order to obtain a more comprehensive understanding of CSR activities in Romanian agriculture.

Our analysis of Ukraine is based on four agroholdings. Further qualitative and quantitative studies of agricultural enterprises and comparisons between agroholdings and other types of enterprises would allow us to shed more light on the role of genuine CSR activities and how CSR implementation corresponds to public CSR communication. Similarly, questions in the surveys on CSR activities in Russia and Kazakhstan could focus on the local community and infrastructure development. Qualitative research in both countries can provide insights into local differences in CSR activities and their rationale in varying developments of local power relations and informal institutions such as norms, values and cultural characteristics. Finally, it would be possible to identify further CSR activities that can only be explained by local peculiarities but are not perceived as CSR measures by the companies or the general population.

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Diagram sources and acknowledgements

Title A rural street with wooden houses and sheds along the field and a winding dirt road in the distance with old power line poles. Image of the village of the outback of Russia © Nina – stock.adobe.com





Michel Kabirigi, Zhanli Sun and Frans Hermans

Involving informal knowledge networks to improve the diffusion of agricultural information: a social network analysis

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Introduction

The Agricultural Knowledge and Innovation System (AKIS) has become a frequently used theoretical and methodological basis for investigating how agricultural knowledge is created and disseminated in a collective process. At the same time, it is possible to analyze which actors, networks and institutional conditions play a positive or negative role in these processes. This broadens the view of agricultural innovation processes, which are no longer understood as being linear, strictly hierarchical top-down processes, but as broadly dispersed developments in which different actors play different roles in solving complex problems related to improving immature and thus ineffective technologies or practices (Klerkx, Van Mierlo & Leeuwis, 2012). With the growing interest in collaborative processes built on eye-level cooperation between actors, collaborative networks have become a popular object of study. In the last decade, AKIS research adopted a network approach that emphasizes the role of knowledge networks in explaining and predicting information flows and their role in enabling smallholder farms to innovate (Hermans et al. 2017).

In AKIS, a distinction is often made between horizontal and vertical networks. In vertical networks, agricultural knowledge is transferred from the top down. Vertical

networks are traditionally found in the environment of state-supported agricultural extension institutions (Leeuwis, 2013). Horizontal networks are more informal networks for disseminating knowledge among farmers themselves. Especially in the weakly developed transition countries of Central Asia and the Caucasus, informal networks are likely to be crucial in the rapid diffusion of agricultural innovations, given the limited capacity of state and parastatal institutions and deficits in formal education. Case studies on this are urgently needed. This study on Rwanda contributes to closing this gap for underdeveloped, increasingly market-oriented economies. Although both governments and other stakeholders have made considerable efforts to increase efficiency in agriculture, there are still significant yield gaps in most Central and East African countries (Clay & King, 2019; Leitner et al., 2020). Informal horizontal knowledge transfer could close the knowledge gap and, hence, the yield gap. Expanding informal channels of knowledge dissemination and integrating them into governmental agricultural extension services thus represents an innovative strategic approach to promoting knowledge exchange (Šūmane et al., 2018).

However, the question of how the integration of informal knowledge dissemination into governmental extension systems could work in practice has received little scientific attention so far. This paper aims to fill this gap by examining formal and informal extension networks for controlling banana leaf wilt (Banana Xanthomonas Wilt, BXW) in Rwanda. BXW is a rapidly spreading plant disease that threatens the livelihoods of banana farmers in Rwanda. Agricultural extension in Rwanda is organized through Twigire Muhinzi, a very well-developed and structured extension system. Agricultural knowledge is passed on both through a state-organized extension service and through a more informal exchange of knowledge among farmers. The official extension service is coordinated by the Rwanda Agriculture and Animal Resources Development Board (RAB) under the Ministry of Agriculture (MINAGRI). The more informal, knowledge-sharing part of the official extension system builds on a community-based extension system that operates through farmer field schools (FFS) and farmer promoters (FP). In the first case, a group of farmers gathers around a farmer field school. In the second case, a farmer promoter organizes a group of farmers (a so-called “Twigire group”) around a demonstration plot. The FFS moderator and the FP promoter are local farmers who have undergone special training provided by the RAB.

Methods

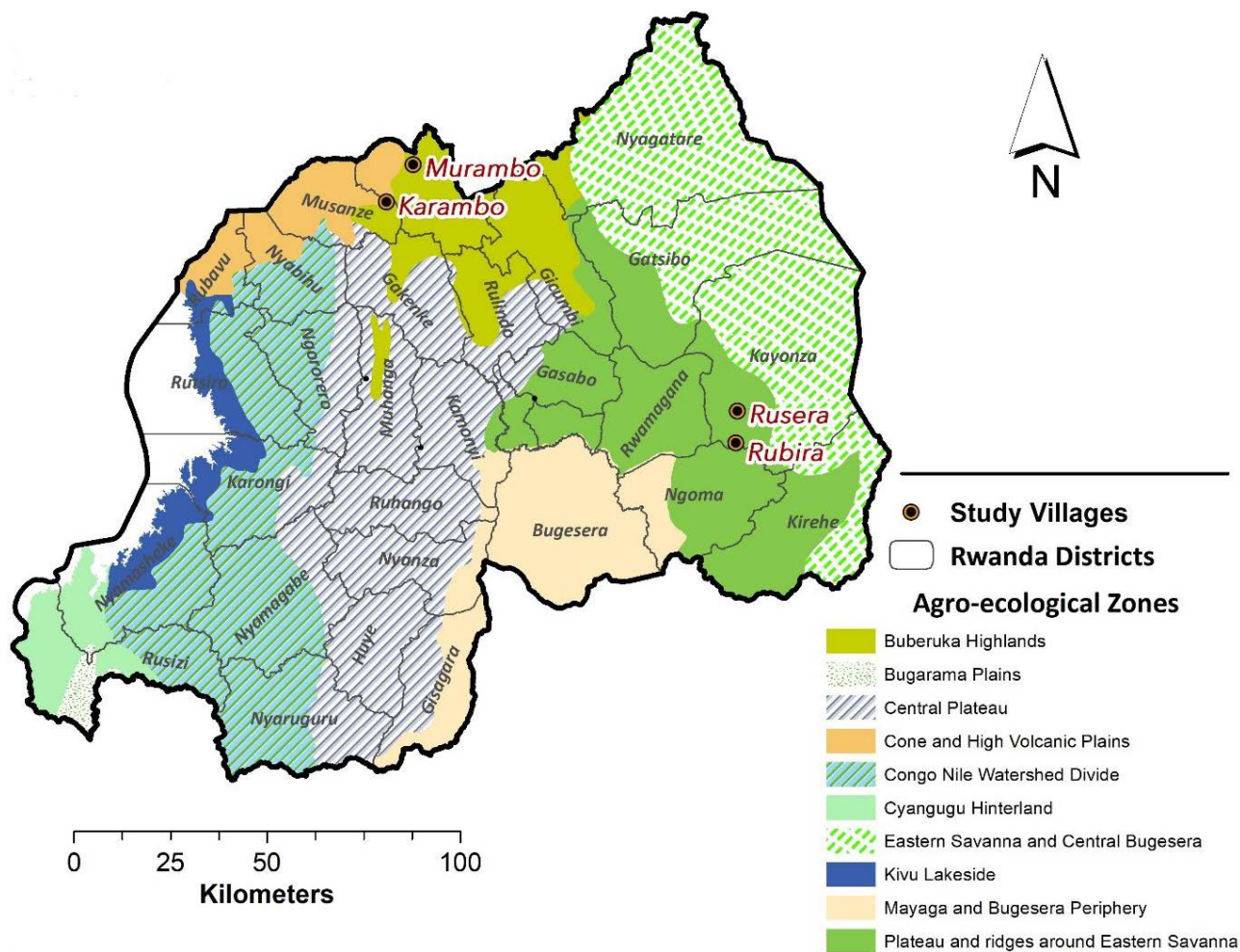
A survey was conducted in two Rwandan districts, Kayanza district in Eastern Province and Burera district in Northern Province, to investigate the structure of the networks (**Figure 1**).

Both districts are banana growing regions, but differ in terms of climate, soil conditions and cultivation methods. Two villages were selected in each district which differ in their distance from the extension services. The survey covered all banana farmers in each village. The data was collected between November 2018 and January 2019 by a team of domestic researchers briefed by the first author. Two guiding questions structured the collection of the social network data:

- 1. Who gave you advice on BXW control?**
- 2. To whom did you give advice on BXW control?**

The analysis and description of the networks in the individual villages was carried out using social network metrics, which measure the relative importance of individual nodes of the network at the level of the network nodes (actors) and enable statements to be made about the degree of networking, centralization and complexity at the network level.

Figure 1: Geographical location of the study villages



Results and discussion

Table 1 shows the main characteristics of the formal and informal extension networks in the four villages. The smallest extension network is found in Karambo (87 nodes) and the largest in Rusera (214 nodes).

Further analysis of the networks focused on the influence of gender and education. A well-known social process that often explains the formation of relationships in social networks is ‘social homophily’ or networking according to the motto “birds of a feather flock together”. People often prefer contact with others with whom they share commonalities such as gender or educational level. **Table 2** contains an overview by gender of the relationships in the four networks. The table does not show a homophily effect, but rather a clear gender disparity in requests for advice within the informal farmers’ networks. Men do not seek advice from women in any of the four villages, and likewise women themselves hardly ever ask for advice from other women.

A second characteristic, the level of education, was included to answer the question of whether school-leaving qualifications influence who seeks advice from whom. For this purpose, the survey participants were asked to indicate their level of schooling. The mixture matrix for each village is shown below. The level of education seems to have only a minor influence on the networks. But it can at least be said that farmers with a higher level of education (high school or higher) generally do not seek advice from farmers without a high school diploma. However, since only a small number of farmers with a high school diploma were interviewed, it is difficult to draw robust conclusions from this finding (**Table 3**).

The data in **Figures 2** and **3** reveal that the informal network is more densely linked than the formal state extension system, which also has a considerable proportion of isolated actors, i.e., farmers whom the official extension network does not reach. This lack of outreach by the formal extension system is confirmed not only by the proportion of isolated nodes in the networks but also by the network density and the average degree of linkage in each of the villages studied (Table 1). Our results show that the informal network does indeed offer the possibility of reaching farmers who cannot currently be reached by the official extension services. This is understandable in view of the fact that there is a shortage of staff for the official extension services measured against the need for extension. However, this lack of official extension may also be an indication of a knowledge gap among farmers in terms of the innovation diffusion process.

Figure 2 shows that the informal networks of banana farmers in the villages studied are highly centralized and develop around a few influential actors who are, however, also farmers. These central nodes in the network are formed by the farmer promoters mentioned above, as well as by farmers officially involved in the village administration. These central actors thus have an important mediating role in that they promote the flow of information from the official extension network to the informal network.

Table 1: The main characteristics of the informal and the formal networks of banana farmers in the villages surveyed

Network	Metric	Rusera	Rubira	Murambo	Karambo
Informal farmer advice network	# Respondents/nodes	214	91	96	87
	Number of ties	215	203	134	164
	Density	0.006	0.015	0.015	0.022
	Average degree	2.324	3.441	2.792	3.770
	Share of isolates	0.162	0.025	0.125	0.023
	Clustering coefficient	0.035	0.056	0.034	0.067
	Assortativity	-0.499	-0.577	-0.492	-0.484
Formal extension network	# Nodes	220	95	102	93
	Number of ties	76	60	88	62
	Density	0.002	0.007	0.009	0.007
	Average degree	0.691	1.263	1.725	1.333
	Share of isolates	0.659	0.368	0.284	0.333
	Clustering coefficient	0	0	0	0
	Assortativity	-0.63	-0.83	-0.62	-0.84

Table 2: Gender mix matrix: number of relationships by request for advice according to gender

	To female	To male
From female	11	315
From male	0	400

Table 3: Number of relationships by request for advice according to level of education

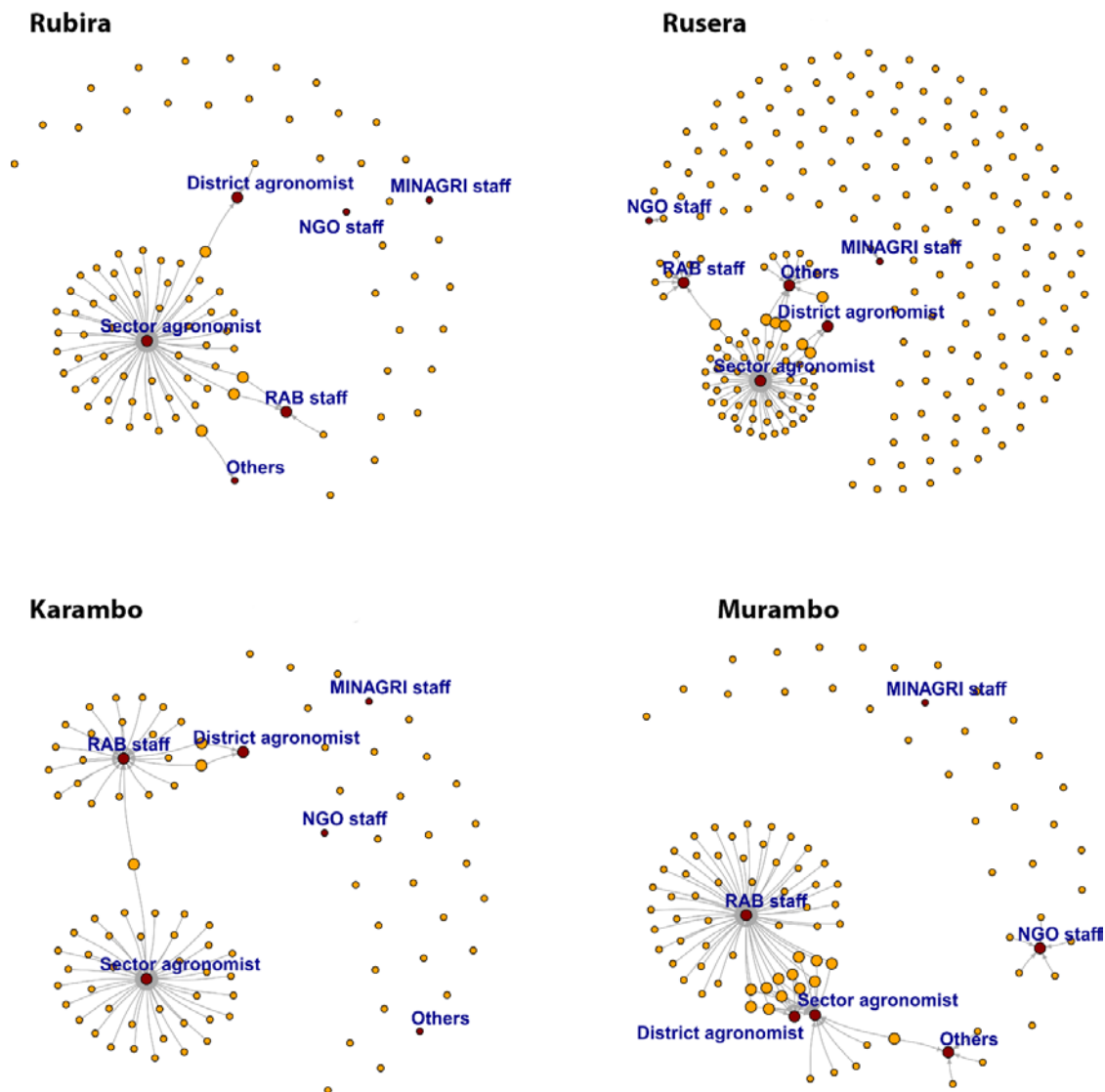
	None	Primary	Secondary+	Total
None	7	137	39	183
Primary	4	372	94	470
Secondary+	2	57	14	73
Total	13	566	147	726

Figure 2: Informal social networks of farmers for advice on controlling BXW in the villages studied



Notes: Node size represents differences in education level, node shape represents differences in age, and node color represents gender.

Figure 3: Formal government extension networks for farmers for controlling BXW



Notes: Red dots represent the official extension entities with their respective names and the remaining dots represent banana farmers in the village.

Discussion and conclusions

This study examines the characteristics of formal and informal extension networks among banana farmers in Rwanda. It found that the formal network is not able to reach all farmers, while the informal network involves far more farmers. Thus, our results suggest that the central actors of the farmers' (informal) networks, farmer promoters and village leaders, should be approached as potential links to the staff of the formal extension service in order to efficiently integrate the informal knowledge transfer into the existing government extension system and to efficiently disseminate information on controlling plant disease. The farmer promoters are already linked to the extension services, however, targeting the village headmen as stakeholders could further improve the integration of informal knowledge transfer into the existing government extension system and prove to be an efficient tool for disseminating information on controlling plant disease.

Literature

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Diagram sources and acknowledgements

Title Two farmers discussing BXW © International Institute of Tropical Agriculture (IITA), Rwanda

Fig. 1 Geographical location of the study villages © Own compilation

Tab. 1 The main characteristics of the informal and the formal networks of banana farmers in the villages surveyed © Own survey

Tab. 2 Gender mix matrix: number of relationships by request for advice according to gender © Own survey

Tab. 3 Number of relationships by request for advice according to level of education © Own survey

Fig. 2 Informal social networks of farmers for advice on controlling BXW in the villages studied © Own compilation

Fig. 3 Formal government extension networks for farmers for controlling BXW © Own compilation

Anna Feshchenko, Sina Lehmann and Franziska Schafft

Bioeconomy – an important step on the way to a sustainable agricultural and food system: the IAMO Forum 2021



Bioeconomy – an important step on the way to a sustainable agricultural and food system: the IAMO Forum 2021

Anna Feshchenko, Sina Lehmann and Franziska Schaft

An intensification of the global competition for resources is expected in the coming decades. Dwindling natural resources, growing population numbers, the emergence of a global middle class and climate change are already posing major challenges to agricultural and food systems around the world. In such less favourable conditions the bioeconomy has the potential to help achieve the sustainable development of agriculture and rural areas.

At the IAMO Forum 2021, entitled, “Agrifood Systems in the Bioeconomy” international experts from the academic community, business and international institutions came together to debate the potential, innovations and possible challenges of the bioeconomy. From 7 to 9 June 2021 in three plenary sessions, one special session with industrial design students from the Burg Giebichenstein University of Art and Design in Halle, 13 parallel sessions and one panel discussion, 315 conference participants discussed suitable development strategies and current findings. To mark the year of bioeconomy in Germany the IAMO Forum 2021, together with the 9th *International Bioeconomy Conference* and the networking event *Digital Incoming BioEconomy. Discovering | Networking | Upscaling*, initiated the first “Bioeconomy Week Halle”.



The online conference was opened by IAMO Director **Alfons Balmann**, who spoke of IAMO’s involvement in the area of bioeconomy. The bioeconomy, he said, should be understood as the process of value creation in the production, processing, conversion and upgrading of biological resources. The bioeconomy has great potential for the development of rural areas, as well as for agriculture and the food economy. IAMO’s research, he added, is focusing on the bioeconomy and its possibilities. The Institute is a founder member of the Leibniz ScienceCampus in Halle – Plant-Based Bioeconomy (WCH), and has three junior research teams looking at agricultural and food systems in the bioeconomy: TRAFORBIT – the importance

of bio-clusters in the transition to the bioeconomy (funded by the German Ministry of Education and Research, BMBF); Bioeconomy – economics and institutions of the bioeconomy (funded within WCH); and LaScalA – International Competence Center on Large Scale Agriculture (funded by the Leibniz Community). Balmann also highlighted possible conflicts of aims between the bioeconomy and the attainment of development goals such as global food security or sustainable agricultural production, which will continue to intensify in an era of climate change. The IAMO Forum 2021 was thus addressing this key question, which includes aspects such as sustainable production and land conversion, innovative entrepreneurship, the transition of global and regional value chains, ethical questions about new technologies and their social acceptance, and the development and taxation of rural areas.

combining economics and ecology for sustainable economic management and has the potential to create new products and processes which conserve resources, create prosperity and ensure success on the relevant markets of the future. She also emphasised the importance for global food security. Because of international trade relations, the German bioeconomy and its material flows are closely interconnected to the bioeconomies of South America, Asia and Africa. National bioeconomic strategies therefore place great importance on observing global boundaries. In addition, more use must be made of suitable land which is less productive or degraded, to satisfy the need for biomass. This will reduce the pressure on fertile soils and natural ecosystems will be preserved. Conflicts, such as between food security and preserving biodiversity, can also be avoided by realising the United Nation's (UN) Sustainable Development Goals (SDG).



Cornelia Berns, head of the sub-department of international cooperation and global food policy in the German Ministry of Food and Agriculture (BMEL), started by saying that the aspiration for a sustainable way of living and economic system was an important impetus for changes in society, business and politics. The bioeconomy aims at

Innovations in agriculture and food systems



Stefanie Bröring, Professor of Technology, Innovation Management and Entrepreneurship at the University of Bonn, opened the first plenary session on 7 June with a lecture on technology transfer and the acceptance of innovation. She explained that new sub-sectors are emerg-

ing within the bioeconomy, such as bioenergy, bioplastics, biomaterials, biopharmaceutics and neutraceuticals, which are applying biological principles and knowledge to other scientific areas. In spite of the new knowledge, however, the diffusion rate of these innovations into the market is still very low. This is because the economy remains largely dependent on fossil fuels and there are still many ways in which the bioeconomy needs to become competitive. She also highlighted the importance of interdisciplinary cooperation in the field of technology transfer and the challenges this poses. New links in the value chain are being created that could be occupied by start-ups. Finally she emphasised the necessity of greater interdisciplinarity within the agricultural sciences and education. Neighbouring disciplines in particular should be better integrated into existing curricula. Moreover, entrepreneurship must be promoted within the green sector to develop fully functioning value chains.



Matin Qaim, Professor of Agricultural Economics at the Georg August University of Göttingen, underlined the importance of new plant-breeding methods for the transformation of agricultural and food systems. These could boost agricultural productivity, help increase plant

diversity and resistance, as well as supporting environmentally sensitive practices and combating poverty. Although genetically modified (GMO) crops have proved themselves to be as safe as conventionally bred crops, the public tends to view genetic technology (especially aspects such as gene transfer and genome editing) as “unnatural” and “risky”. The legal regulations often follow suit. He suggested, therefore, that the focus should be on plant properties and their use rather than breeding methods. Qaim investigated the two most important plant properties that could be developed with recombinant DNA technologies – insect resistance and herbicide tolerance – and concluded that they could lead to better yields, higher profits for farmers and a reduction to some degree in the use of chemical pesticides. He also warned against overregulation in this field, as this could further stoke public concern that new plant technologies are dangerous. Furthermore, overregulation makes the technology unnecessarily expensive and leads to a concentration of the industries in large countries, few crops and few plant properties with high commercial potential. Qaim came to the conclusion that although new plant-breeding technologies are not a panacea for the agricultural and food sector, there are clear signs that they can boost food security as well as sustainable development in agriculture. Qaim believes there is need for an open-minded discussion in society, a better regulation policy and greater competition in plant biotechnology.



Linxiu Zhang, director of the UN Environment Programme – International Ecosystem Management Partnership (UNEP-IEMP), gave an overview of the greatest challenges facing agricultural and food systems today: the loss of biological diversity, the degradation of ecosystems and climate change. Overcoming these challenges needs a rapid implementation of coordinated solutions inside and outside the food system. She emphasised the necessity of a system-based One Health approach, in which the health of the environment, hu-

man and animals are interlinked. The UNEP-IEMP sees this as an efficient way of conveying food-system policy to the public. Zhang spoke of the need to break the vicious cycle of poverty, ecosystem degradation and climate change by shifting from a sectoral approach to a so-called Nexus approach. For this reason the UNEP-IEMP is currently running a flagship programme on climate, ecosystems and livelihoods to help developing countries attain the SDGs. Since 2016 the UNEP-IEMP has run projects in more than 20 countries, which use the Nexus approach. Zhang believes it will help improve the resilience of agricultural and food systems, as it takes into consideration the needs of all concerned. These projects outline concrete options for livelihoods by considering the interests of the community and their finances, combining ‘traditional knowledge’ with scientific findings, encouraging political ownership and participation, and supporting women in the important role they play in attaining sustainability goals.

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The IAMO Forum 2021 was organised by the Department of Structural Development of Farms and Rural Areas. For the preparation and overall coordination, Franziska Schaft and Anna Feshchenko were responsible. The academic part of the pro-



gramme was organised by Liodmila Chatalova and Frans Hermans. They also moderated the second and third plenary sessions, which were thematically dedicated to responsible research and innovation and policy options respectively.



For the realisation of the IAMO Forum as an online conference, the support of Tim Illner, a staff member for network administration and technical support, was indispensable.



The publicity support of the event was taken over by Sina Lehmann from the Press and Public Relations Office.

An excursion into bioeconomic practice with the University of Art and Design Burg Giebichenstein



The semester project **Designing full circle(s) with and for (regional) bioplastics**, led by Burg professor Mareike Gast, was a link between the IAMO Forum 2021 and the 9th International Bioeconomy Conference. In the special session with industrial design students on the second day of the conference, the bioeconomy with regard to raw materials and products, as well as its experimental side, was vividly illuminated.



For the first time in the context of an IAMO Forum, prospective designers presented concepts for circular products and ideas for using bioplastics. In addition to experiments with bacterial cellulose or the membrane of chicken eggs, concepts were presented for textiles made from chicken feather waste, a backpack made from polyhydroxybutyrate, and a glasses frame made of chitosan.

Detailed information on the project **Designing full circle(s) with and for (regional) bioplastics** be found at:
🔗 www.burg-halle.de/en/design/industrial-design/industrial-design/student-works-and-projects/project/full-circle-2/



Production and processing of biomass

The second plenary session on 8 June focused on responsible research and innovation. In her paper **Patricia Osseweijer**, Professor and head of the Biotechnology and Society section at Delft University of Technology



in the Netherlands, raised the issue that scientific data on environmental impact do not take into account the public's emotional concerns. She highlighted that the research agenda for rural development must include social goals that are tailored to the needs of the local communities, such as the use of bioenergy or measures for social development. She finished by saying that the bioeconomy is a transition in which the right questions on ethics and values must be addressed using relevant facts.

Andreas Pyka, Professor of Innovative Economics at the University of Hohenheim, looked at substitution, structural change and transformation in the bioeconomy. According to Pyka, the original and too narrowly-defined notion of the bioeconomy as a substitution of oil-based resources by bio-based resources influences our technology-oriented understanding of the bioeconomy, es-



pecially in the economic sciences. Traditional perspectives from engineering and economics dominate current norms and colour the public perception of the bioeconomy. He questioned the suitability of the neo-classical substitution approach for explaining a sustainable economy and proposed the use of experimental behaviour approaches. He recommended redesigning innovative systems as so-called Dedicated Innovation Systems, which could trigger paradigm shifts.

Christina Pinsdorf, research associate at the Institute of Science and Ethics (IWE) at the University of Bonn, looked



at the ongoing ethical challenges of the green bioeconomy from a philosophical perspective. She came to the conclusion that the bioeconomy is neither a panacea for

the various crises of the Anthropocene Epoch, nor sustainable per se. Economic growth influences the natural systems on which it is based and the social systems in which it is embedded. For this reason the bioeconomy, which is still closely linked to the concept of economic growth and prosperity, must be oriented in a way that helps humanity achieve ethical and environmental goals.

The third plenary session addressed policy options. **Dimitris Diakosavvas**, Senior Economist, Agriculture



and Resource Policy Division, Trade and Agriculture Directorate at the Organisation for Economic Cooperation and Development (OECD) in France, gave a presentation on the bioeconomy and sustainability of agricultural and food systems. He outlined that food systems are facing three major challenges: combating malnutrition and hunger, livelihoods and environmental sustainability. By creating new business, innovation and employment opportunities, increasing the efficiency and productivity of natural resources and adapting to climate change, the bioeconomy can make an important contribution to the sustainable development of agricultural and food systems. He argues that although many countries have seen remarkable progress and greater adoption of measures

related to the bioeconomy, they are often counterproductive and not aligned with policy goals. There is thus a growing need to develop a new paradigm for research and innovation in the agricultural and food system as a whole, which focuses on research for development rather than research and development, and attaches greater importance to institutions and the inclusion of interest groups. Another important challenge is the development of a generic conceptual framework for monitoring progress. This should help focus awareness on measuring progress, and identifying potential opportunities and risks.

Kean Birch from the Innovation Policy Lab at York University in Toronto, Canada, is researching the construction



of markets and nature in the bioeconomy, especially in relation to biofuels. He has noticed a declining interest in the biofuel discussion. He stated that the production volumes of conventional biofuels in the the USA and Europe have been virtually stable in recent years. remained stable. He explained this with a significant production of cellulosic biofuels. In addition, he said, the „demand“ for bioethanol is being driven by by the U.S. Environmental Protection Agency. However, the „supply“ is limited

by the 10 per cent blending limit. There are three major policy challenges in relation to investment: support, sustainability and developing markets that can stimulate the production of biofuels.

Meeting global and regional needs

On the third day of the IAMO Forum 2021 the concluding panel discussion took place on the topic of “From extracting to creating value in the bioeconomy”. The event, moderated by the journalist **Christiane Grefe**, focused



on the potential of the bioeconomy for value creation, as well as possible risks and public reservations. The discussion addressed other aspects besides technological perspectives, such as the role of policymaking, society and the environment, and the conflict of aims between them. To cover all sides of this complex subject the panel included representatives from research, industry and NGOs. Amongst the panellists were Professor Julius Wesseler (Wageningen University), Martin Lanfer (Brain Biotech AG), Peter Gerhardt (denkhausbremen e.V.) and Professor Regina Birner (University of Hohenheim).



Justus Wesseler, Professor at Wageningen University and President of the International Consortium on Applied Bioeconomy Research (ICABR), researches biotechnology, state intervention in the market and the development of sustainable value chains. His introductory statement outlined plant-breeding methods in the EU, which currently are strictly regulated. In his opinion, this is making innovation difficult. He called for objectivity in the debate, which he was keen to provide with scientific facts from his research. Distinctions need to be made between approval procedures, albeit without disregarding the risks. Furthermore, it would be beneficial if international standards were harmonised with mutual recognition of the processes.

Martin Langer, biochemist and member the executive board at BRAIN Biotech AG, took part in the panel as a representative from industry. He sees the bioeconomy as a knowledge-based interface to make economic processes more sustainable. The bioeconomy can provide solutions to urgent issues such as population growth, consumption and climate change. He regretted that although Europe has an excellent research community, there are problems when it comes to production. He highlighted difficulties in capital procurement and



regulatory hurdles. These will put Europe at a competitive disadvantage. Like Julius Wessler he called for internationally uniform regulatory standards. Overall, however, his view of the bioeconomy is a positive one, as businesses will be under greater pressure to operate sustainably (e.g. through higher prices for emissions) and improve their technology. A variety of approaches are thus becoming economically viable.

Peter Gerhardt, Director of denkhausbremen e.V. (Bioeconomy Action Forum) focused in the discussion on socially sustainable aspects. In his view, there is the danger that the bioeconomy will exacerbate existing social problems. For example, many raw materials in the bioeconomy are from the Global South. He advocated that raw materials should be sourced and used as regionally as




possible and kept within the value-added cycle. He believes science has an obligation to fulfil in genetic technology. It must address the reservations that the population have. It is also necessary to broaden the debate about genetic technology and produce a democratically legitimate consensus. Gerhardt also called for a renegotiation of research funding. Currently, he said, it is too closely market oriented and it favours technological-bio-technical processes. Holistic aspects of the bioeconomy, by contrast, are afforded too little consideration.

Regina Birner is Chair of Social and Institutional Change in Agricultural Development at the University of Hohenheim and member of the Bioeconomy Council. She insisted that the two paradigms of the bioeconomy – “extracting” and “creating” – are not fundamentally contradictory. A way must be found to harness the potential of the bioeconomy without losing sight of the risks. The current parameters for this, however, are unsuitable. Actors from politics, industry and NGOs often have fixed ideas on certain topics and are hesitant to move from their positions. It is necessary, therefore, to settle conflicting aims in a broad public dialogue, although a scientific basis first needs to be established for this. She also stated that regulatory law is not necessarily the best



way to guarantee best environmental practice. Instead a variety of different approaches are needed.

The IAMO Forum 2021 was organised by the Institute's Department of Structural Development of Farms and Rural Areas, and funded by the German Research Foundation (DFG) and the Rentenbank. Cooperation. Partners were the Leibniz ScienceCampus Halle – Plant-Based Bioeconomy (WCH), the Bioeconomy Cluster, the International Competence Center on Large Scale Agriculture (LaScaIA), the BioMonitor Project and the International Consortium on Applied Bioeconomy Research (ICABR).

You can find detailed information on the IAMO Forum 2021 at:  <https://forum2021.iamo.de>

Sources and picture references

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Michael Kopsidis

IAMO – a brief portrait

IAMO – a brief portrait

Michael Kopsidis

Aims and tasks

Since 1994 the Leibniz Institute of Agricultural Development in Transition Economies (IAMO) has been investigating the far-reaching economic, social and political processes of change in the agricultural and food sector, and in the rural areas of its geographical area of research. This extends across Central, Eastern and South-Eastern Europe. The transition countries of Central and Eastern Asia, especially China, have been added to this remit. Research into Central Asia, in particular, has been intensified over the past few years.

In spite of great efforts and much success, the development of the agricultural and food sector in many of these regions still lags far behind that of Western industrial nations, and some of them are following their own, very specific development paths. Furthermore, a huge gulf is emerging between successful and stagnating regions within individual countries, as well as between states themselves. Beside a wide variety of structural factors, the different transition processes, which still have an effect today, go a long way to explaining the divergence. Large emerging nations such as Russia and China, as well as Ukraine and Kazakhstan, have risen to become “global players” on world agricultural markets. We need to determine what must happen in these key economies to boost environmentally sustainable economic growth in agriculture and the food sector, and ensure

long-term national and global food security despite the growing demands being placed on agricultural resources. In the countries we cover, but not only in these, adapting agriculture and land use to climate change in a globalising economy also represents a major challenge. Digitalisation is now also a factor for the agricultural and food sector in our partner countries. All these factors ensure that IAMO’s research brief is very broad, both thematically and regionally.

The impact of IAMO’s research on decision makers in agricultural policy, politics, business and science in its partner countries has become substantially greater. Increasingly the Institute is no longer just focusing on policy advice in its target regions, a classic area of applied (agro-)economic research, but shaping development in all its various facets with research that is firmly embedded in agricultural practice.

The Institute is also devoting more attention to devising efficient strategies for successful rural development that counteracts unregulated economic migration from rural areas.

With its thematic and geographical focus, IAMO is a unique global research institution. Since its establishment in 1994 it has been a member of the Leibniz Association as a non-university research centre. The Leibniz Association includes research institutes which are scien-

IAMO is increasingly focusing on sustainable scientific capacity-building in the Eurasian transition economies, which transmits widely in agricultural practice.

tifically, legally and commercially independent, together with service institutions. Both these are jointly funded by the federal administration and the Länder to address current problems of national interest.

 www.leibniz-gemeinschaft.de/en

As mentioned above, the aim of IAMO's work is not just to help understand, but also overcome the major challenges and ongoing development deficits in the agricultural and food sector, as well as in the rural areas of the Institute's geographical area of research. This goal gives rise to the **three core tasks of the Institute**:

- **Internationally oriented research into agricultural and food economics including the development of rural areas.**
- **Exchange of ideas between the academic, business and political communities.**
- **Support for young academics.**

The Institute sees itself as a driving force of international research into agricultural economics. Outstanding research is the engine of the Institute's development, and it creates the conditions in which the other two core tasks can be performed. For instance, IAMO acts as a forum for exchange, and in this way it supports the international cross-linking of German research and dialogue between decision makers from the academic, political and busi-

ness communities. At the same time IAMO is focusing increasingly on international-quality scientific capacity building directly in our partner countries. Unprecedented major challenges face the agricultural sector and policy in our target countries. In view of this, IAMO is not only providing scientifically based policy advice, but increasingly we are undertaking research closely linked to agricultural practice, in close cooperation with a wide variety of actors in our partner countries. The Institute also uses its expertise and capacities to help academic scholars become fully qualified. Here there is a particular focus on supporting young academics from partner countries. Through its international orientation and cooperation with other teaching and research institutes, IAMO is helping to strengthen the profile of Halle (Saale) as a centre of science and research in Central Germany. Our close cooperation with Martin Luther University Halle–Wittenberg (MLU) – especially with the Institute of Agricultural and Food Sciences at the Faculty of Natural Sciences III, and with the Economic Sciences Department at the Faculty of Law and Economic Sciences – is an important factor here.

Academic departments, research fields and key topic areas

IAMO's threefold research structure with the departments **Agricultural Policy**, **Agricultural Markets** and **Structural Development** (abbreviated titles) is derived

from the orientation of its research. The basic conditions of agricultural policy and opportunities for shaping policy, markets in the agricultural and food sector, and the development of farms and structures in rural areas are all analysed by the Institute. Developments at individual farm level and in rural areas, the creation of functioning agricultural markets, and the shaping of agricultural policy are all closely interlinked. Decisions relating to farm development and agricultural policy, as well as market processes also have an impact on human–environment interaction in rural areas. In addition, they have an effect on the two key issues of the future: food security and food safety.

IAMO's academic work is organised interdepartmentally into five key research areas which focus on major problem areas of agricultural development in Eurasian transition countries and emerging nations. The more intensive level of communication in key research groups counteracts any possible fragmentation of research. Besides positive bundling effects, greater individual responsibility of the key research groups allows efficient, result-oriented research management.

The new research areas are:

- I. Policies and institutions
- II. Natural resource use
- III. Livelihoods in rural areas
- IV. Organisation of agriculture
- V. Agricultural value chains

The current medium-term agenda for 2016–22 is focusing more closely on the following:

- **The impact of global processes on the economy and environment of the study region**
- **Developments in Central Asia, the Caucasus region, Russia and Ukraine**
- **Comparative analyses between countries**
- **Interdisciplinarity of research**
- **Dialogue with society, politics and business**

Institutional structure

IAMO is a foundation under public law. Its bodies are the **Foundation Board**, the **Executive Board** and the **Scientific Advisory Board**. The Institute is divided into three academic departments:

- I. **External Environment for Agriculture and Policy Analysis, Head of Department is Prof. Dr Thomas Herzfeld**
- II. **Agricultural Markets, Marketing and World Agricultural Trade; Head of Department is Prof. Dr Thomas Glauben**
- III. **Structural Development of Farms and Rural Areas; Head of department is Prof. Dr Alfons Balmann**

Together with the head of **Administration and Central Services/Technical Support, Katja Guhr**, the heads of the academic departments form the Executive Board of the Institute. Since January 2013, all four directors of the institute are equal managing directors with joint responsibility.

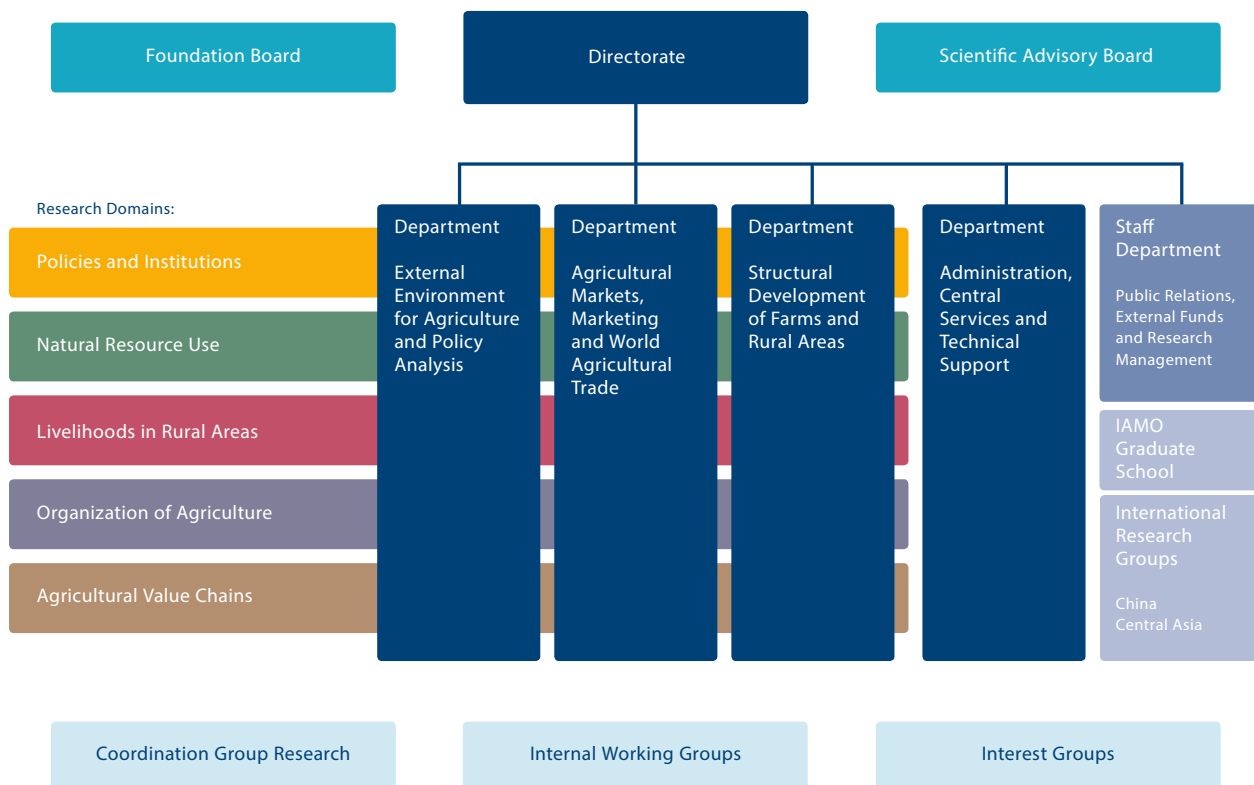
In coordination with the Foundation Board, this collegial body conducts the Institute's business and directs IAMO's long-term research and development planning.

The Scientific Advisory Board advises the Directorate and the Foundation Board on scientific matters and regularly evaluates the Institute's performance.

From r. to l.: Prof. Dr Dr h.c. Thomas Glauben, Katja Guhr, Prof. Dr Thomas Herzfeld, Prof. Dr Alfons Balmann



Organisation chart



On 1/1/2022 the following were members of the Foundation Board:

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- **Dr Michael Lehmann**, Chair, Saxony-Anhalt Ministry of Science, Energy, Climate Protection and the Environment
- **MinDirig'n (Head of Section) Cornelia Berns**, Vice Chair, Federal Ministry of Food and Agriculture
- **Dr Simone Fritz**, Saxony-Anhalt Ministry of Science, Energy, Climate Protection and the Environment
- **Dr Lothar Hövelmann**, German Agricultural Society (DLG), DLG Centre of Expertise for Agriculture
- **MinR. (Undersecretary) Jobst Jungehülsing**, Federal Ministry of Food and Agriculture
- **Prof. Dr Sebastian Lentz**, Leibniz Institute for Regional Geography, Vice-President of the Leibniz Association

- **Prof. Dr Martin Odening**, Humboldt University, Berlin, Department of Agricultural Economics
- **Prof. Dr Wolfgang Paul**, Martin Luther University Halle–Wittenberg, Prorector for Research

On 1/1/2022 the following were members of the Scientific Advisory Board:

- **Prof. Dr Martin Banse**, Chair, Johann Heinrich von Thünen Institute (TI), Brunswick
- **Prof. Dr Hermann Lotze-Campen**, Vice Chair, Potsdam Institute for Climate Impact Research (PIK)
- **Prof. Dr. Štefan Bojnec**, University of Primorska, Slovenia
- **Prof. Dr Gertrud Buchenrieder**, Bundeswehr University Munich
- **Prof. Dr Imre Fertő**, Centre for Economic and Regional Studies (KRTK), Hungary
- **Prof. Dr Robert Finger**, ETH Zurich, Switzerland
- **Prof. Dr Sebastian Hess**, University of Hohenheim
- **Prof. Dr ir. Miranda Meuwissen**, Wageningen University and Research (WUR), Netherlands
- **Prof. Dr William H. Meyers**, University of Missouri, USA
- **Prof. Dr Insa Theesfeld**, Martin Luther University, Halle–Wittenberg (MLU)
- **Prof. Dr Katarzyna Zawalińska**, Institute of Rural and Agricultural Development, Poland

Cooperation with university institutions



MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG

Since February 1998 IAMO and MLU have been working together under a comprehensive cooperation agreement, which includes joint appointments. IAMO's work is especially closely linked with the Institute of Agricultural and Food Sciences, which is part of the Faculty of Natural Sciences III at MLU, and the Economic Sciences Department at the Faculty of Law and Economic Sciences. The heads of IAMO's academic departments take part in MLU's teaching and committee work. Several academic members of staff from IAMO with post-doctoral and doctoral qualifications are also involved in university teaching, and in the running of a nationwide PhD student programme. Staff links between MLU and IAMO are also strengthened by the fact that MLU's Prorector of Research, Prof. Dr Wolfgang Paul, sits on IAMO's Board of Trustees.

Cooperation between MLU and IAMO assumed a new dimension when the **Leibniz ScienceCampus – Plant-Based Bioeconomy (WCH)** was opened in Halle in June 2012. The ScienceCampus aims to strengthen the interdisciplinary collaboration between the Halle-based Leibniz Institutes and the corresponding academic departments at Martin Luther University Halle–Wittenberg in the sphere of plant-based bioeconomy. There is also close cooperation with MLU in the **Leibniz ScienceCampus Eastern Europe – Global Areas (EEGA)**, which was officially opened in January 2017. EEGA is supported by Leibniz Association institutions, the Max Planck Society,



the Fraunhofer Society and several universities in Central Germany. Both campuses will boost higher education in the Halle (Saale) region, as well as supporting knowledge and technology transfer in politics, business and public life.

One element of IAMO's intense academic capacity building in its partner regions has been the establishment of permanent local structures integrated into universities. As part of the **IPReS project (An Innovative Pilot Program on the Re-Integration of Scientists to Central Asia: Research and Capacity Building on Food Chains under Climate Change)** a joint **Uzbek–German chair** was founded at Tashkent State Agrarian University. Within the **UaFoodTrade project (Pilot Project for the Sustainable Internationalization of Ukrainian Research Structures in the Context of the Globalization of the Ukrainian Food Sector)**, financed by the BMBF, a joint **IAMO-KSE office** was established at Kyiv School of Economics (KSE).

At a formal ceremony on 20 August 2021 in Yekaterinburg, Russian Federation, a **Memorandum of Understanding** was signed between Ural State Economic University (UrSEU) and IAMO.

Furthermore, the signing of a cooperation treaty between IAMO and the National University of Life and Environmental Sciences of Ukraine (NUBiP) in April 2021, has given new impetus to the **Cooperation in Agricultural Research between Ukraine and Germany**.

IAMO works in close conjunction with many other universities, chiefly with faculties of agriculture and economics. Depending on the requirements of interdisciplinary research, other social science and humanities subjects may be brought in, e.g. human geography and history. As far as our partners in Germany are concerned, we have strong links with **Berlin, Bonn, Göttingen, Gießen, Hohenheim, Kiel, Munich and Münster**. In addition to its collaboration with Martin Luther University Halle–Wittenberg, IAMO has had a comprehensive cooperation agreement with the Humboldt University in Berlin since 2010. There are close relationships, too, with chairs of agricultural economics and institutes at agricultural and economics colleges and universities in our partner countries.

Amongst our partner universities abroad we should give special mention to: in **China**, Peking University, Beijing Normal University, China Agricultural University (CAU), all three in Beijing, Sichuan Agricultural University (SAU) in Chengdu, Huazhong Agricultural University (HZAU), Northwest A&F University in Xianyang and Nanjing Agricultural University; in **Russia**, the Higher School of Economics (HSE) and the New Economic School (NES), both in Moscow, and the Ural State Economic University (UrSEU) in Yekaterinburg; in **Ukraine**, the Kyiv School of Economics (KSE), the National University of Life and Environmental Sciences of Ukraine (NUBiP) – Kiev, and Zhytomyr National Agro-Ecological University (ZNAU); in **Uzbekistan**, the Samarkand Veterinary Medicine Institute (SamVMI), Tashkent State Agrarian University (TDAU), Westminster International University Tashkent, the National University of Uzbekistan (NUU), Karalpak State University, Tashkent (KSU), and the Tashkent State University of Economics (TSUE); in **Kazakhstan**, the Kazakh

National Agrarian University (KazNAU) and the Kazakh Agro Technical University; in **Kyrgyzstan**, the University of Central Asia (UCA); in **Egypt**, Cairo University (CU); in **Thailand**, Kasetsart University, Bangkok; in **Slovenia**, the University of Primorska, Koper; in **Serbia**, the University of Belgrade and the University of Novi Sad; in **Romania**, the University of Agronomic Sciences and Veterinary Medicine of Bucharest (UASMV); in **Moldova**, the State Agrarian University of Moldova; in **Kosovo**, the University of Pristina; and in the **Czech Republic**, the Czech University of Life Sciences (CZU), Charles University Prague and Masaryk University in Brno. In addition, IAMO maintains a wide range of scientific exchange with Wageningen University and Erasmus University Rotterdam, both in the **Netherlands**; in **Denmark**, the University of Copenhagen; and in **Sweden**, the Swedish University of Agricultural Sciences (SLU) in Uppsala. Other partners are the Catholic University in Leuven, **Belgium**; the University of Natural Resources and Life Sciences (BOKU), **Austria**; the University Institute of Lisbon, Center for Psychological Research and Intervention (ISCTE), **Portugal**; the University of Bologna, **Italy**; the University of Iceland in Reykjavik, **Iceland**; in Britain, the University of Kent, the University of Bath, the University of East Anglia and the University of Glasgow; and in **France**, the La Rochelle School of Business and NEOMA Business School, Reims. In the **USA** we have close contacts with Stanford University, the University of Missouri (Mizzou), Pennsylvania State University (PSU) and the University of Wisconsin-Madison. In South America, our partners are the University of Buenos Aires (FAUBA), **Argentina**; and the University of São Paulo, Ribeirão Preto in **Brazil**.

Cooperation with non-university institutions

The extensive contacts with non-university institutions are also very important for IAMO's work. We collaborate with the **Johann Heinrich von Thünen Institutes of Farm Economics, Rural Studies, and Market Analysis and Agricultural Trade Policy** in Brunswick-Völkenrode (TI); the Leipzig-based **Leibniz Institute for Regional Geography (IfL)** and the **Leibniz Institute for the History and Culture of East-Central Europe (GWZO)**; the **Leibniz Institute for Economic Research (IWH) in Halle**; the **Potsdam Institute for Climate Impact Research (PIK)** and **German Committee on Eastern European Economic Relations**.

There are close relations with many non-university research institutions abroad, especially in **Central** and **Eastern Europe**, **Southern Europe**, and **Central** and **Eastern Asia**. We have excellent and regular professional contact with institutes in academies of sciences or agricultural sciences, regional research institutes and advisory organizations, as well as agricultural economics research institutes that are subordinate to the corresponding ministries of agriculture.

Of note here are: in **China**, the Center for Chinese Agricultural Policy (CCAP) and the Institute of Geographical Sciences and Natural Resources Research, both at the Chinese Academy of Sciences in Beijing; in **Ukraine**, the Ukrainian Agribusiness Club (UCAB), the Ukrainian Agricultural Confederation and the Ukrainian Agricultural Council; in **Russia**, the All-Russian Institute for Agrarian Problems and Informatics (VIAPI) in Moscow, and the North-Western Research Institute of Economy and Organization of Agriculture, Saint Petersburg-Pushkin; in **Kazakhstan**, the Analytical Center of Economic Policy

in the Agricultural Sector (ACEPAS) and the Public Fund Center of Applied Research TALAP, both in Astana, the Kazakh Scientific Research Institute of Cattle Breeding and Fodder Production (KAZNIIZHIK) and the Regional Environmental Centre for Central Asia; in **Uzbekistan**, the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME), the Tashkent Institute of Architecture and Civil Engineering (TIACE) and the Samarkand State Architectural and Civil Engineering Institute (SamSACEI); in **Kyrgyzstan**, the National Statistical Committee of the Republic of Kyrgyzstan; in **Armenia**, the International Center for Agribusiness Research and Education (ICARE); in **Georgia**, the Georgian Center for Agribusiness Development (GCAD); in **Azerbaijan**, the Institute of Scientific Research on Economic Reforms (ISRER); in **Kosovo**, the Ministry of Agriculture, Forestry and Rural Development; in the **Czech Republic**, the Institute of Agricultural Economics and Information (UZEI), Prague; and in **Serbia**, the Institute of Agricultural Economics, Belgrade. Other partners are the National Agricultural Technology Institute (INTA) in **Argentina**; in **Spain**, Orkestra Basque Institute of Competitiveness, San Sebastian; in **Greece**, the Agricultural Economics Research Institute (AGRERI); and in **France**, the French Agricultural Research Centre for International Development (CIRAD).

Our partners amongst international organisations are: the Food and Agriculture Organization of the United Nations (FAO), especially the FAO Regional Office for Europe and Central Asia in Budapest; the World Bank; the International Food Policy Research Institute (IFPRI); the International Water Management Institute (IMWI-CGIAR), the International Center for Agricultural Research in the Dry Areas (ICARDA) and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics).

Leibniz ScienceCampus 'Eastern Europe – Global Area'



The **Leibniz ScienceCampus 'Eastern Europe – Global Area' (EEGA)** has been up and running in Central Germany since July 2016. In the context

of global challenges its aim is to improve research about and in the countries of Eastern Europe. In cooperation with other research institutions, IAMO is investigating the globalisation of Eastern European and Central Asian regions through economic ties, geopolitical changes, cultural exchange and migration movements. The Leibniz ScienceCampus EEGA offers the participating institutes excellent interdisciplinary opportunities for cooperation in their research and transfer activities as well as in further academic education and training. There is a particular focus on communicating research findings to the media and wider public. The ScienceCampus is being funded by the Leibniz Association for four years. Under the leadership of the Leibniz Institute for Regional Geography (IfL), the other institutions involved are IAMO, the Universities of Leipzig, Halle–Wittenberg and Jena, the Max Planck Institute for Social Anthropology in Halle, the Fraunhofer Center for International Management and Knowledge Economy (IMW), the Leibniz Institute for Jewish History and Culture – Simon Dubnow (DI) and the Leibniz Institute for the History and Culture of East-Central Europe (GWZO). Ever since its founding, EEGA has been financially supporting IAMO's activities. These include the financing of research visits lasting several months, as well as supporting IAMO Forum workshops. For example, in 2018 EEGA funded two symposiums or-

ganised by IAMO in Belgrade on the digitalisation of the agricultural and food economy. In May 2020 the senate of the Leipzig Association agreed to finance EEGA for a further four years.

Promotion of young academics

Promoting young academics is one of IAMO's three core tasks, and is carried out at a variety of levels, some of which are interlinked.

Postgraduate education: IAMO Graduate School, seminars and Doctoral Certificate Programme



At the end of 2021, 59 PhDs were being supervised, of which 29 were written by women. The majority of doctoral students are from IAMO's partner countries. As part of

the "Pact for Innovation and Development", which corresponds to the excellence initiative of the German government and the *Länder* to promote science and research at German universities, the Institute established the **IAMO Graduate School** in 2007. Starting out for four years as a pilot measure, since 2011 the Graduate School has become a fixed and permanent component of PhD training at IAMO. All doctoral students at IAMO are automatically members of the Graduate School. With its systematic support for PhD students the IAMO Graduate School is the central element of the **Early-Career Scientist Programme (ECSP)**, which since 2019 has combined IAMO's varied activities in supporting young academics. The Graduate School is also the link to the **Doctoral**

Certificate Programme of agricultural economics institutes in Germany, Austria and Switzerland. Since 2012 the IAMO Graduate School has also been a member of the **International Graduate Academy (InGrA)** of Martin Luther University Halle-Wittenberg, which has further extended the close cooperation between IAMO and Martin Luther University.

The Doctoral Certificate Programme in Agricultural Economics was established in 2005 by IAMO, the Johann Heinrich von Thünen Institute (TI) and institutes of agricultural economics at several German universities.



www.agraroekonomik.de

It offers the first structured training in Germany, Austria and Switzerland for doctoral students in the areas of agricultural and food economics and rural development. The systematic teaching of essential theory and method aims to increase the quality of students' education and improve efficiency when working on dissertation topics. Doctoral study is the third stage of a consecutive study programme, following bachelor's and master's degrees in agriculture, food and the environment.

The Doctoral Certificate Programme is jointly run by the Agricultural and Food Economics Faculty at Christian Albrecht University in Kiel, the Faculty of Agriculture at the Rhine Friedrich Wilhelm University of Bonn, the Institute of Agriculture and Horticulture at the Humboldt University in Berlin, the departments of Agricultural Sciences, Ecotrophology and Environmental Management at Justus Liebig University Giessen, IAMO, the Faculty of Agricultural Sciences at the University of Hohenheim, the Institute of Agricultural and Food Sciences at Martin Luther University Halle-Wittenberg, the department of

Ecological Agricultural Sciences at Kassel University, the Faculty of Agricultural Sciences at Georg August University in Göttingen, the Faculty of Economic Sciences and Center of Life and Food Sciences Weihenstephan at Munich Technical University, the Faculty of Agricultural and Environmental Sciences at the University of Rostock, the University of Natural Resources and Life Sciences (BOKU) in Vienna, ETH Zürich, and the Thünen Institute, Brunswick. The PhD course is based on a modular system.

In 2021 IAMO professors and staff collaborated on the courses for the following modules:

- **“The Political Economy of Agriculture in Developing and Emerging Countries”**
- **“Introduction to Geographic Information Systems and Spatial Data Analysis”**
- **“Agent-Based Modelling in Agricultural and Resource Economics”**
- **“High Quality Research Data – Sources, Collection and Processing”**

The teaching programme is continually being developed. With an eye on possible gaps in the current programme, supplementary seminars on theory and method are specifically offered to ensure that doctoral students have a comprehensive, international-standard education. Thus, in addition to the teaching within the Doctoral Certificate Programme in Agricultural Economics from the Graduate School, study skills courses – e.g. in the areas of **methodology training, soft skills** or **research management** – are organised and financed. There have been sessions on “Basic Principles of Research Design and Strategy” (October 2020) and “Media Communication for

Researchers” (July 2021). Doctoral students can also apply for sessions on specific areas or funding to take part in external courses. In addition the Graduate School supports PhD students with their enrolment, application to faculties and administrative matters relating to doctoral study, as well as providing information about university offers and initiatives or workshop possibilities at IAMO partner institutions.

Since March 2012 IAMO has also been a full member of the **International Graduate Academy (InGrA)** at Martin Luther University Halle–Wittenberg. InGrA supports the establishment of all forms of structured doctoral programmes, coordinates existing programmes, thereby helping create a productive research environment taking into account the university’s internationalisation and equality strategies

 <https://www.ingra.uni-halle.de>

Together with the agricultural economics professors of business, agricultural market theory, agricultural business management, and agricultural, food and environmental policy at MLU’s Institute of Agricultural and Food Sciences, the IAMO Graduate School also runs a PhD student seminar. This seminar acts as a forum for scientific exchange about research questions, methodological approaches and findings.

In 2021 four academics who had been working at IAMO for several years successfully defended their theses at MLU:

- **Arjola Arapi-Gjini:** Migration, remittances and well-being in Kosovo. (Institute of Agricultural and Food Sciences)

- **Kerstin Marit Uhl:** Russian market power in international wheat trade and implications for global food security. (Institute of Agricultural and Food Sciences)
- **Yangyi Zheng:** Role of risk preferences, incentives and governance structures on pesticides use in vegetable production in China. (Institute of Agricultural and Food Sciences)
- **Maximilian Heigermoser:** The rapid rise of Russia's wheat exports: Price formation, spot-futures relations and volatility effects. (Faculty of Law and Economic Sciences)

In addition, IAMO staff assessed four theses that were defended at other universities besides MLU:

- **Minjie Chen:** Market Failures, factor allocation and input use in Chinese agriculture. (Agricultural Economics, Wageningen University)
- **Evidence Chinedu Enoguanbhor:** Urban land dynamics in the Abuja city-region, Nigeria: integrating GIS, remotely sensed, and survey-based data to support land use planning. (Geography Department, Humboldt University, Berlin)
- **Akem Nina Fabinin:** Essays on agri-food markets in West and Central Africa. (Faculty of Agricultural and Nutritional Sciences, Christian Albrecht University, Kiel)
- **Daniel Landholm:** Cross-scale drivers of greenhouse gas emissions and local solutions for climate change migration. (Albrecht Daniel Thaer Institute of Agriculture and Horticulture at the Humboldt University, Berlin)

Whereas the Graduate School focuses on training PhD students, in 2021 young academics and guest researchers on the aforementioned Early-Career Scientist Programme (ECSP) also enjoyed wide-ranging support in organisational issues relating to the connection with MLU and in bureaucratic matters. In addition the ECSP gives advice on mentoring programmes run by partner institutions, supports the Graduate School in developing additional study skills courses for methodology, is expanding the Institute's welcome service and providing a large volume of information. IAMO's alumni work was also expanded by the ECSP in 2021.

Equal opportunities at IAMO

At IAMO, measures for promoting equal opportunities and ensuring the compatibility of family and career, are first and foremost directed at creating a working environment which taps and boosts the potential of all staff. For many years IAMO has satisfied the research-oriented equality standard and implemented a family-friendly staff policy. The formal basis for gender equality is provided by the Women's Promotion Act (FrFG) of the state of Saxony-Anhalt and an individual agreement signed with the Saxony-Anhalt Ministry of Economics, Science and Digitalisation of the state of Saxony-Anhalt in 2019. Adjusted to the Institute's circumstances, the GWK's "Equality Agreement" and the DFG's "Research-Oriented Equality Standard" are the basis for formulating new objectives. Correspondingly, IAMO has an honorary equality officer and a deputy – both women. In conjunction with the Directorate they are devising an **equality policy** as well as an internal plan for **supporting women**. All members of the Institute can access these via the intranet.

Besides professional equality of opportunity for all genders based on talent, potential and skills, the Institute places great emphasis on ensuring the **compatibility of family and career** and developing this further. Making equality of opportunity and compatibility of family and career fundamental elements of working life comes from conscious personnel management, career development and promoting young academics, as well as from being part of the **Dual Career Network of Central Germany (DCNM)**. IAMO has also reinforced its family friendly staff policy through its membership of the **'Family Success Factor' business network**.

Having been awarded a positive "Total E-Quality" rating for equal opportunities in 2013 and 2016, both valid for three years, in 2020 the Institute opted for certification by the **"audit berufundfamilie"** (career and family audit, BUF). This seal of quality is awarded by the advisory board berufundfamilie Service GmbH for three years, recognising the commitment of businesses, institutes and universities that have a **personnel policy sensitive to family and different phases of life**. Certification is awarded for successfully completing an audit process in which, besides an inventory of measures already in place, strategic goals are developed and adhered to. The implementation of these agreed targets and programmes for action are reviewed annually during the certification period. The Institute has been certified since its successful audit in December 2020.

To accelerate equality measures and embed them institutionally, IAMO, through the programme **"Supporting the creation of equal opportunities between women and men in science and research (FEM-Power)"**, which is financed by the European Social Fund (ESF) and Saxony-Anhalt, has successfully gained

funding for the post of an equal opportunities and diversity coordinator. The project is running for five years. At the centre of the FEM-Power programme is promoting women's careers in the so-called MINT field (Maths, IT, Natural Sciences and Technology), in which women are underrepresented. Since 1/5/2021 Kristin Leimer has been the equality and diversity coordinator at IAMO. At the heart of her work is supporting female staff in career planning and advancement. Besides organising workshops on career-related topics and setting up a coaching programme, she also provides individual advice and guidance for female staff, and gives information about other opportunities, such as participation in mentoring programmes. To strengthen networks and ensure the visibility of female staff, events are organised such as Career Talks and Female Expert Talks. The FEM-Power appointee also supports female staff when they arrive at the Institute. The equality officer, personnel department and Directorate are together drawing up a Gender Equality Plan, which will be published on the Institute's website.


After consideration of qualification requirements, IAMO is committed to embracing factors of diversity (equality, internationality, inclusion) when filling jobs and aiming for a balance of men and women. The necessary parameters for this are the cascade model taken from the DFG and adopted by the Joint Science Conference (GWK) of the central government and *Länder* in 2011. According to the cascade model, career perspectives for female staff members at IAMO continued to move in a positive direction in 2021; in some important areas the Institute has succeeded in maintaining the equality that has been attained.

Franziska Appel, IAMO's equality officer, who was re-elected in December 2020, is part of the Leibniz As-

sociation's equal opportunities and diversity working group. Since March 2018 she has been member of the Leibniz Association's council of equality officers, and its deputy chair since March 2020.

Prizes and awards

For her work "An investigation into the relationship between the subjective well-being and (relative) wealth in Germany" IAMO's  **Antje Jantsch** was given the Best Dissertation, Second Place Award on 4 September 2021 by the International Society for Quality-of-Life Studies (ISQOLS).

IAMO's  **Yanjun Ren** was commended by the Journal of Integrative Agriculture for his outstanding article in the periodical in 2020.

International China Research Group at IAMO



The China Research Group, set up in 2008, is a collection of German, European and Chinese academics working in agricultural economics, which currently has 40 members. Its aim is the structural and sustained international interlinking of IAMO's research activities into economic and social processes in rural areas of the People's Republic of China.

In 2021 the members of the research group were working on 13 projects, covering a broad range of topics but with particular focus on "Living standards in rural areas", "The use of natural resources" and "Coordination in value chains".

 <https://china.iamo.de/research/current-research-projects/>

The spectrum of topics includes the productivity of Chinese agriculture, the effects of land market liberalisation, an analysis of social, health and education policies as well as the impact of Chinese environmental programmes on environmental resources and rural living conditions. Other studies are looking into the complex relations between land use and the environment as well as trade issues and aspects of food security. The individual projects are aiming to help find solutions for economic, social and environmental problems in rural China. At the heart of these is the issue of how to shape political and economic parameters effectively. The output from these projects in 2021 includes 19 refereed articles.

In 2021 several doctoral projects were being worked on within the China Research Group. One of these has now been successfully completed. Yangyi Zeng submitted his thesis entitled "Role of risk preferences, incentives, and governance structures on pesticides use in vegetable production in China" to MLU and successfully defended it.

Repeated visits by IAMO staff to China have proven to be an important instrument of successful research collaboration. Guest visits to IAMO by foreign, especially Chinese colleagues, are also essential for aligning research work accurately to current developments. Amongst its guests the IAMO China Group has welcomed Liangzhi You from the International Food Policy Research Institute (IFPRI) as well as Lan Fang from the Northwest Institute of Historical Environment and Socio-Economic Development, Shaanxi National University.

Despite the massive restrictions imposed by the COVID-19 pandemic, there was plenty of exchange with Chinese research partners. A high point of activity in the China Group was a China Session with prominent at-

tendees during the IAMO Forum 2021, which because of the pandemic took place online. With a series of digital lectures, members of the Research Group contributed to the online learning opportunities for young academics at Huazhong Agricultural University (HZAU). Together with HZAU and the University of Melbourne the China Group organised the online conference “International Conference on Natural Resource Management and Public Policy”. We should also mention papers given at the Sino–German Agribusiness Conference, which was also held in hybrid format. Another milestone was a summer school on the topic “Innovation processes” for students at Huazhong Agricultural University.

A new focus in the area of digitalisation may point the way for the Research Group’s future work. In 2021 a research project started entitled “Digital Transformation of China’s Agriculture” (DITAC). This project will evaluate the status quo, mechanisms and impact on resource use, trade and food security. The project is being financed by the German Ministry of Education and Research (BMBF).

International IAMO Central Asia Research Group



IAMO’s Central Asia Research Group is a network of academics set up in 2019, working on interdisciplinary research into agricultural, socioeconomic, and environmental transition processes in Tajikistan, Turkmenistan, Kazakhstan, Kyrgyzstan and Uzbekistan.

 <https://centralasia.iamo.de/home/>

There are also individual studies on neighbouring regions if the specific skills of the Central Asia Research

Group are needed. The modern, multidisciplinary research is not just aimed at an academic audience, but is geared towards influencing policy and the transfer of scientific findings to business. Besides research and transfer to society as a whole, a particular focus is on scientific capacity building. The Research Group carries out intensive academic exchange and collaboration with various research institutions in Central Asia, including Tashkent State Agrarian University (TSAU), Tashkent State Economics University (TSEU), the Tashkent State Institute of Irrigation and Agricultural Mechanization Engineers (TI-IAME), the University of Central Asia (UCA) and Westminster International University in Tashkent (WIUT).

On 11 November 2021 the Uzbek Minister of Agriculture, Jamshid Khodjaev, and IAMO Director Thomas Glauben signed a Memorandum of Understanding in Munich, which will further intensify the cooperation between IAMO and the Uzbek Ministry of Agriculture. The document cites four main aims. First there will be greater collaboration to modernise teaching and education at Tashkent State Agrarian University and other universities, as well as various research institutes. Second, research and teaching capacities, including in the area of digitalisation and the food economy, needs to be expanded. Third, they are looking towards a systematic exchange of experience and knowledge relating to the effects of climate change and the corresponding adaptation in the Uzbek agricultural and food economy. Finally, IAMO and the Uzbek Ministry of Agriculture will cooperate closely in the area of knowledge-based transfer of policy and technologies.

On 18 November 2021, as part of the KlimALEZ project (Increasing climate resilience via agricultural insurance – Innovation transfer for sustainable rural devel-

opment in Central Asia), there was an online workshop presenting the project's findings to representatives from business, politics and research. Beside presentations of new data tools and their application there was a panel discussion with representatives from regional businesses talking about their experiences with piloting agricultural insurance in their countries.

At the end of 2021 three large projects on capacity building in Central Asia were carried out by the Research Group, which include the creation of an academic chair and doctoral study courses: IPReS – An Innovative Pilot Programme on the Re-Integration of Scientists to Central Asia: Research and Capacity Building on Food Chains under Climate Change; SUSADICA – Structured Doctoral Programme on Sustainable Agricultural Development in Central Asia; DSinGIS – Doctoral Studies in GeoInformation Sciences. A large project, KlimALEZ, is aiming to help the development of agricultural insurance in the region. In 2021 two projects were looking at the Development of a Risk Management Concept for Small Farmers in Armenia and Azerbaijan (RIMARA), and the effects of COVID-19 on agriculture and food in the Central Asian and Caucasus countries.

Guests and fellowships at IAMO

The further training and education of academic scholars is one of IAMO's core tasks. As mentioned above, IAMO focuses chiefly on supporting young academics from its partner countries. Of great importance in this regard are study visits by researchers, which can range from a few weeks to two years. Besides being involved in joint publications, those who come for long-term visits also concentrate on their doctoral studies, financed by exter-

nal and IAMO grants, and third-party funded projects. In 2021 IAMO had 43 fellows who were predominantly working on their theses. Over the same period two visiting academics carried out research at the Institute.

By working together closely on international, third-party funded research projects, young researchers from partner countries integrate themselves into the international academic community. Former IAMO staff, both from Germany and partner countries, are now working in international organisations such as the EU and World Bank, or they have acquired management positions in their respective national agricultural administrations. An even larger number of them are continuing their academic careers back in their home countries.

Development of third-party funding

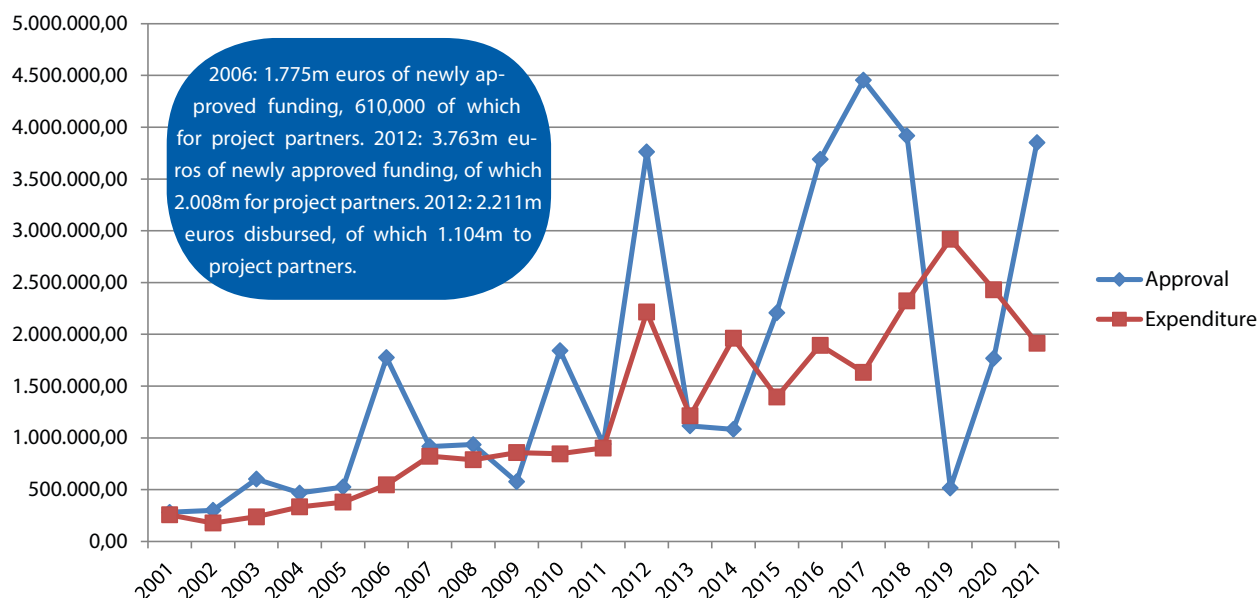
Project title (January 2021 – December 2021)	Funder	
I. Newly approved research projects with third-party funding		
Rural well-being in transition: multidimensional drivers and effects on (im)mobility	RuWell	Leibniz Association
Transnational Families, Farms and Firms: Migrant Entrepreneurs in Kosovo and Serbia from the 1960s to today	TraFFF	Leibniz Association
Monitoring of policy implementation and impact assessment for Republic of Moldova – subcomponent Impact Assessment	MDA-Impact	FAO
Analysis of Export Markets for Special Agricultural Markets	FAO Export Markets	FAO
EU Assistance for Uzbekistan Agri-Food Development Strategy 2020–2030	EU Assist Uzb	EU Europe Aid
Agricultural Policy Dialogue Germany–Western Balkans	APD Westbalkan	BMEL
Joint project: Digital Transformation of China’s Agriculture (DITAC); sub-project: Resources, Trade and Food Security	DITAC	BMBF
Preparations for the establishment of a German–Ukrainian centre of excellence. Working title: German–Ukrainian Centre of Excellence for Smart Agriculture and Food Economics (GUCE-SAFE)	GUCE-SAFE	BMBF
Promoting Resilience and Food Security through Risk-Contingent Credit in Africa	Risk-Contingent for Resilience	BMZ
ERA-Net joint project: ERA-FDC-Policies – Agricultural potential in Russia taking account of climate protection, climate adaptation and rural development. Sub-project: Mapping land-use change and modelling yields and carbon changes	ERA-FDC-Policies	BMBF ERA–Net
Towards Resilient and Sustainable Agro-Ecosystems through Appropriate Climate-Smart Farming Practices	TRUSTFARM	BLE ERA-Net

Project title (January 2021 – December 2021)		Funder
Land reform in Ukraine: New perspectives and challenges for sustainable development of the agricultural sector and rural areas	Landreform UA	DAAD
Ensuring economic sustainability in the seafood industry	SEAVID19	Research Council of Norway
Multiplatform delivery of co-development tools for national control and prevention of Banana Xanthomona Wilt in Rwanda: Scaling innovation for enhanced Banana production and Food Security	GIZ Banana Wilt II	GIZ
Development of a Risk Management Concept for small farmers in Armenia and Azerbaijan	RIMARA	Deutsche Sparkassenstiftung
Agrifood Systems in the Bioeconomy IAMO Forum 2021	IAMO FORUM 2021	Landwirtschaftliche Rentenbank
II. Ongoing projects with third-party funding		
Perceptions of inequality through social comparisons and transference on subjective wellbeing: a micro perspective on reference groups	Wahrnehmungen_Bu and Wahrnehmungen_JM	DFG
Agricultural Land Markets – Efficiency and Regulations sub-project 6 Impacts of strategic behaviour on land market dynamics and regulation effects	FORLand II_Balman FORLand II_Appel FORLand II_Graubner	DFG
Agricultural Land Markets – Efficiency and Regulations sub-project 7 Quantifying the concentration of land ownership and trade-offs in agriculture	FORLand II_Müller	DFG
Agricultural Land Markets – Efficiency and Regulations sub-project 3 Investigating Market Scepticism Regarding Agricultural Land Markets	FORLand_Jauernig	DFG
Structured doctoral programme on Sustainable Agricultural Development in Central Asia	SUSADICA	VolkswagenStiftung
An Innovative Pilot Program on the Re-Integration of Scientists to Central Asia: Research and Capacity Building on Food Chains under Climate Change	VW IPReS	VolkswagenStiftung

Project title (January 2021 – December 2021)		Funder
Institutions, change mechanisms and impacts in natural resource management of Central Asia	INRESCA	VolkswagenStiftung
Modelling individual decisions to support the European policies related to agriculture	MIND STEP	EU Horizon 2020
Rural NEET Youth Network: Modeling the risks underlying rural NEETs social exclusion	RNYN	EU COST Action
What can digital communications do for generational renewal in farming?	Young Farmers	EU MSCA
Doctoral Studies in GeoInformation Sciences	DSinGIS	EU ERASMUS+
German–Ukrainian Agricultural Policy Dialogue	APD Ukraine	BMEL
Sino–German Agricultural Centre	DCZ	BMEL
The role and functions of bioclusters in the transition to a bioeconomy	TRAFOBIT	BMBF
Joint project on climate adaptation: Increasing climate resilience via agricultural insurance – Innovation transfer for sustainable rural development in Central Asia. Sub-project 1: Joint coordination, data collection on insurance projects and experiments	KlimALEZ	BMBF
Promotion of gender equality for female scientists at IAMO	FEM Power	Investitionsbank Sachsen-Anhalt
Land use and land cover change impacts of the sorghum and millet upscaling project in Mali	LULCC	Biodiversity International
III. Completed projects with third-party funding		
AgriPoliS2020 – Sustainability of research software AgriPoliS	AgriPoliS2020	DFG
Research Group Agricultural Land Markets – Efficiency and Regulations Sub-project 6: Can agricultural land-market regulations fulfil their promises? Agent-based simulation studies for select German regions	ALM_Balman (FORLand)	DFG

Project title (January 2021 – December 2021)		Funder
Research Group Agricultural Land Markets – Efficiency and Regulations Sub-project 7: Spatio-temporal analysis of the effects of land markets on agricultural enterprises and the environment	ALM_Müller (FORLand)	DFG
Setting up a group of young researchers in the field of “Economics and Institutions of the Bioeconomy”	WCH Nachwuchsforschergruppe	Leibniz Association
International Competence Center on Large Scale Agriculture	LaScala	Leibniz Association
Determinants of Iran’s Red Meat Crisis: Multidisciplinary Analysis of Supply Chain Governance	Red Meat Crisis	LFV “Krisen einer globalisierten Welt”
Understanding food value chains and network dynamics	VALUMICS	EU Horizon 2020
Towards sustainable and resilient EU farming systems	SURE Farm	EU Horizon 2020
The impact of COVID-19 on agriculture, food and rural areas in Central Asia and Caucasus countries	SARS-CAC	FAO
Pilot project for the sustainable internationalization of Ukrainian research structures in the context of the globalization of the Ukrainian food sector	UaFoodTrade	BMBF
AgriDigital	AgriDigital PPP Serbia 2019	DAAD
Young Farmer Payments: effectiveness of policy implementations after the 2013 CAP reform in Slovenia	PPP Slovenia 2020	DAAD
Dr Daniel Müller working as editor-in-chief for the Journal of Land Use Science	Journal Müller	Journal of Land Use Science
Citizen Science and ICT for Advancing the prevention and control of Banana Xanthomonas Wilt (BXW) in East and Central Africa	GIZ Banana WILT I	GIZ
Contract for consulting services	Consulting Tashkent Institute	Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

Development of third-party funding 2001–2021



Selected third-party funded projects

Below is an outline of important third-party funded projects that are good examples of IAMO's extensive activities in its target countries. These projects combine high-quality academic work with comprehensive transfer activities. They are carried out in such a way that the findings generated in dialogue with business, politics and the public make an effective contribution to solving urgent problems and issues of the future.

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DITAC – Digital Transformation of China's Agriculture – Resources, Trade and Food Security

Funded by the German Ministry of Education and Research (BMBF), DITAC began on 15 September 2021. It is set to run for 18 months with the possibility of a further 18-month extension. The background to this project is

the fact the need for high-quality, healthy and varied food has risen around the world. In countries like China, which have a comparatively low supply of natural resources in relation to its population, this need is covered by intensive agriculture or through imports. For several years it has been hoped that the burden will be relieved by digital strategies, which should help make domestic pro-



duction and food chains more sustainable, more crisis-resilient and more sparing with resources.

Starting with a systematic assessment of the status quo of digitalisation in agriculture and trade in China, there will be econometric and behavioural economic analyses of the adaption and implementation of selected technologies, as well as an empirical evaluation of their economic and environmental consequences. The findings will serve as the basis for discussing future development paths, and as an impact assessment of digital transformation processes from a global perspective. At the same time they will provide important indications of the impact on international trade relations. On the one hand the project is the starting point for the establishment of an international competence centre “Digital Innovations in Transition Economies” at IAMO. On the other, the project findings, as part of a comprehensive transfer programme, will be refined for, and conveyed to, politicians and business as well. The diffusion of the project findings – for example on innovation transfer mechanisms or the resource-saving impact of individual technologies – into the business and political communities should occur via IAMO’s existing implementation projects.

Partners in the project are the Institute of Agricultural Economics and Development at the Chinese Academy of Agricultural Sciences (IAED-CAAS), the Macro Agriculture Research Institute at Huazhong Agricultural University (MARI-HZAU), the International Food Policy Research Institute (IFPRI) and the Sino–German Agricultural Centre.

APD Westbalkan – Agricultural Policy Dialogue Germany–Western Balkans

Following the APD Ukraine and the DCZ (the Sino–German Agricultural Centre), IAMO is now also participating in the newly established APD Westbalkan. This Agricultural Policy Dialogue is also commissioned and funded by the German Ministry of Food and Agriculture (BMEL). The APD Westbalkan began on 1 July 2021 and will initially be financed for 18 months. Leading the project is the Rural Development Standing Working Group (SWG), based in Skopje, North Macedonia. Members of the SWG are the Ministries of Agriculture of Albania, the Federal State of Bosnia and Herzegovina and its territories, North Macedonia, Serbia and Kosovo. SWG’s aim is to promote agricultural policy cooperation in the Western Balkans. Besides SWG and IAMO, other project partners are the German Ministry of Food and Agriculture (BMEL), the Ministries of Agriculture and Rural Development of the countries in the region and IAK Agrar Consulting GmbH.

The current project aims at strengthening regional cooperation in the field of rural development policy, taking account of the guidelines of the EU’s “Green Agenda” for the Western Balkans and of the Common Agricultural Policy (CAP) 2021–2027. Specifically, the project aims at strengthening regional cooperation with regard to harmonisation of legislation and market development in the wine industry, greater regional cooperation over rural development policy and creating a regional Agricultural Knowledge and Innovation System (AKIS) to promote innovation.

MIND STEP – Modelling Individual Decisions to Support the European Policies Related to Agriculture



Funded by Horizon 2020, the EU research and innovation programme, MIND STEP started on 1 September

2019. The project is running for four years. The background to the project is the fact that the CAP ought to be making a contribution to the Paris Agreement on climate change and meet the United Nations' sustainability targets. Efforts and suggestions to rework the CAP aim at efficient measures that are region and business specific, and better linked to environmental, climate protection and ecosystem performance. This development requires a new generation of instruments for evaluating policy impacts, which in particular are able to record decision processes at business level. Here the goal of the MIND STEP project is to establish a model toolbox. In this:

- I. Economic models for individual decision-making will be developed and expanded.**
- II. These models will be empirically tested and calibrated.**
- III. The use of agricultural and biophysical data will be improved.**

MIND STEP employs modern econometric methods as well as innovative techniques from the field of machine learning. By closely cooperating with various interest groups these can help shape the development of the MIND STEP model toolbox, and help apply it to selected regional, national and European policy scenarios.

IAMO is taking the leading role in work package 6 (validation and policy evaluation). The Institute is also involved with the agent-based models AgriPoliS and FarmAgriPoliS, which as part of the MIND STEP model toolbox are applied to relevant policy questions, developed further and (potentially) linked to other models. Coordinated by Wageningen University, the MIND STEP project is a collaboration between 10 partners from six European countries and the European Commission's Joint Research Centre (JRC).

RIMARA – Development of a Risk Management Concept for Small Farmers in Armenia and Azerbaijan

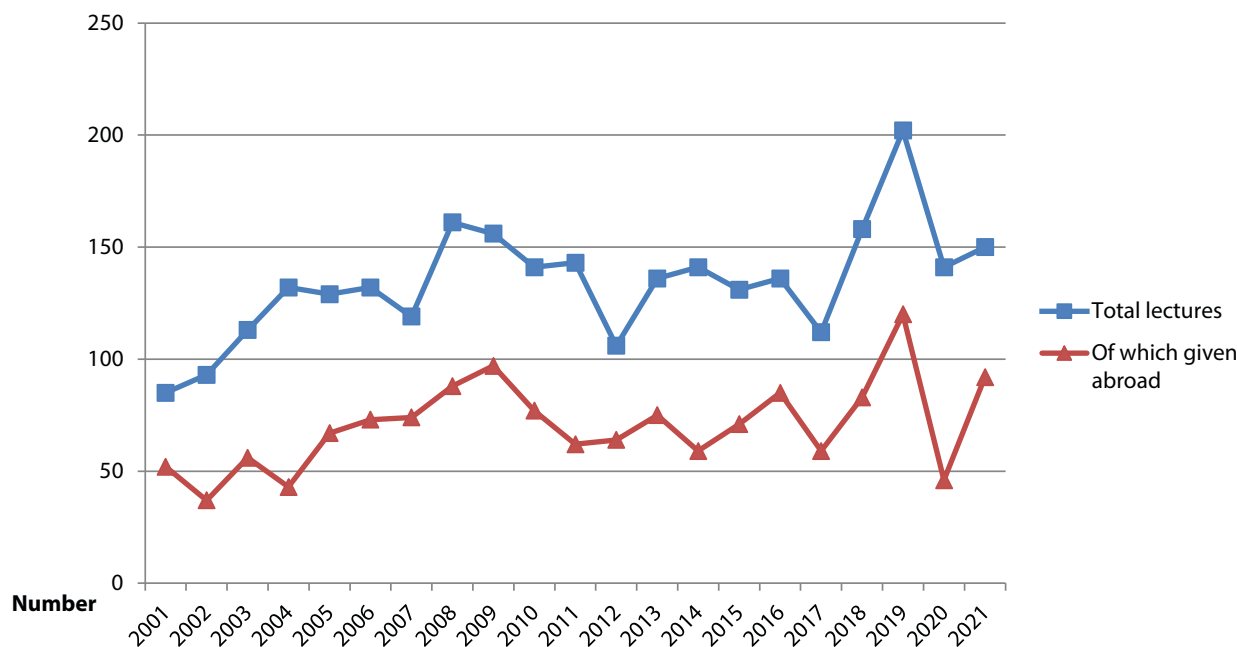
Funded by the Deutsche Sparkasse Foundation for International Cooperation and the German Ministry of Economic Cooperation and Development (BMZ), the RIMARA project ran for just under five months. Within that time the IAMO team set itself the goal of generating accurate, real-time and reproduceable information about historical and future climate and weather patterns. These are then combined with available agricultural land data to better understand climatic risks in Armenia and Azerbaijan. The team has also forecast temperature and precipitation up to 2100 to be able to assess the possible consequences of climate change on the most important crops in the region. The findings of these analyses, which include prognoses of long-term climate changes, as well as changes in the severity and intensity of extreme weather, allow crop-specific climate risk indices to be developed. The data and findings are shared in a web mapping service platform to inform stakeholders about past and expected future climate risks.

IAMO lecture activity

Besides publishing their work, another important task of IAMO staff is the presentation and discussion of research findings at national and international conferences, forums and workshops. A large proportion of lectures by IAMO staff are delivered at international events. In 2021 the costs of the 150 lectures delivered were either covered wholly by the organiser (27), by third-party fund-

ing (29) or other sources (18). There was mixed funding for 11 lectures, while 61 lectures were fully funded by IAMO's budget. Four lectures were paid for privately by the speaker. The reduction in the total number of lectures and of those delivered abroad by about a quarter in 2021, compared to 2019, was COVID-related.

Development of third-party funding 2001–2021



Conferences and seminars

Conferences and seminars are key to IAMO's being able to fulfil its third core task, which is to act as a forum for the exchange of scientific ideas in all questions of agricultural development in transition countries. The events organised by the Institute represent an important platform for scientific exchange, both nationally and internationally. Besides greater academic collaboration, the meeting of academics with decisionmakers from the food industry and politics often provides an important impetus for restructuring in the agricultural and food sectors in partner countries. At the same time, direct and intensive contact with decisionmakers from the regions allows IAMO to orient its research to the actual conditions in these localities. Here we should also highlight the fact that in the field of agricultural economics IAMO makes an important contribution to scientific capacity building in research and teaching in our partner countries, and has a crucial role in developing long-term viable networks. Below is an outline of the most important conferences, symposia and workshops – besides the IAMO Forum – organised by the Institute in 2021.

International scientific online conference on natural resource management

The 4th "International Conference on Natural Resource Management and Public Policy", jointly organised by Huazhong International University (HZAU) in China, IAMO and the University of Melbourne in Australia, took place online on 22 and 23 October 2021. Focusing on climate protection and sustainable resource management, the conference covered a broad spectrum of topics, such

as the sustainable safeguarding of natural resources, ecosystem services, the development of the bioeconomy, economic transition, reducing carbon emissions and the implementation and impact of innovations. Taking part in the conference were more than 400 participants from around 20 countries, including China, Germany, France, Denmark, Australia, Ireland, the Netherlands and the USA.

On 22 October, following a short opening session chaired by Anlu Zhang from HZAU, 16 research papers on various topics were presented. These included payments for ecosystem services, water rights reform in China, institutional land reforms in transition countries, the development of the bioeconomy and industrial ecology. Speakers included Alexander Pfaff from Duke University, Van Butsic from the University of California Berkley, Mark Wang from the University of Melbourne, Justus Wesseler from Wageningen University, and Thomas Herzfeld and Zhanli Sun from IAMO.

On 23 October more than 50 young researchers presented their work in six parallel sessions on the topics of "Urban and rural development", "Environmental management and institutional innovation", "Green space and carbon neutrality", "Farmland management", "Natural resource efficiency and sustainability" and "The natural resource market".

The conference is held every two years and the lead organiser is Huazhong Agricultural University. IAMO was also a co-organiser of the 2019 event. Over the past few years cooperation between the two institutions has borne further fruit, e.g. through professional exchange, joint publications and summer schools. This year's conference was another opportunity for IAMO and HZAU to create a platform for international researchers to dis-

cuss the latest theories, methods and findings about the management of natural resources. Besides academic exchange, the event also allows the IAMO China Research Group to develop existing partnerships and forge new contacts with China.

Sino–German Agribusiness Conference on “Approaches to Sustainable and Modern Management”

The Sino–German Agribusiness Conference took place on 2 and 3 June 2021 as a hybrid event in Nanjing, China. It served as a platform to promote the exchange of experiences and findings between German and Chinese businesses, business associations, policymakers and researchers on topics investigated by the Sino–German Agricultural Centre (DCZ). Taking part in the conference were representatives from the Chinese and German Ministries of Agriculture, MARA, BEMRL, the Chinese and German agricultural and food industries, as well as from universities and research institutions. The main speakers were high-ranking representatives from academia, politics and the industry. Lectures in the individual sessions dealt with practical solutions and approaches for modern and sustainable agriculture, including animal husbandry, seeds and crops.

The parliamentary undersecretary in the German Ministry of Food and Agriculture (BMEL), Hans-Joachim Fuchtel and Sui Pengfei, Director General of the Department for International Cooperation in the Chinese Ministry of Agriculture and Rural Affairs (MARA), represented both ministries in their opening speeches. The conference focused on the topics of “Modernisation of Animal Husbandry” and “Modernisation of Crop Farming”, sup-

plemented by in-person and online presentations on the digitalisation in agriculture and examples of modern strategies to modernise and improve the sustainability of agriculture. Panel discussions with questions from the public offered a platform for further – and lively – debate with experts from China and Germany. The hybrid event was attended by around 200 participants at the conference location, Nanjing Dongjiao State Guesthouse. More than 10,000 people followed the conference via live streaming or Zoom.

The conference was rounded off by a visit to Nanjing Baima Agricultural Demonstration Park in Jiangsu, where the latest digital technologies are being used to produce high-value agricultural goods such as blueberries, beef and mutton. Various Chinese media reported on the event. People’s Daily, the biggest Chinese newspaper, also carried a brief report of the event. A finding of the conference is that digitalisation in Chinese agriculture is necessary to achieve sustainable development. Only through the joint efforts of the government, business and scientific research can digitalisation in Chinese agriculture be widely promoted and implemented practically.

IAMO expert panel at Green Week 2021

Climate change as well as regional and global crises, such as the COVID-19 pandemic and African Swine Fever, are unsettling producers and consumers alike. Given this background, around 500 people from business, politics and academia took part in an online panel discussion on 22 January 2021 on the topic “How better to cope with change: New approaches for food system resilience to pandemic and climatic shocks”. As usual the event took

place as part of the Global Forum for Food and Agriculture (GFFA) and was organised by the German Agribusiness Alliance (GAA) in conjunction with IAMO.

In a keynote speech Daniel Müller, deputy head of IAMO's Structural Change department, explained that crises such as the COVID-19 pandemic and climate change are causing great insecurity in the agricultural sector. Climate change in particular, including extreme weather events such as heavy rain and drought, mean that "production shocks" will be more severe than ever in the future and this, in turn, will have a substantial impact on food systems. To be able to respond adequately to this worsening situation, there must be an improvement in knowledge and technologies. The production portfolio needs to be diversified to avoid reliance on a few basic foodstuffs. Agronomic innovations, including better land management and biotechnologies, must be disseminated and the international trade in food must be supported. Many regions need greater infrastructure investment, he said, and an expansion in food-storage possibilities. It is also necessary to improve early-warning systems for extreme weather events as well as risk management via data gathering and index insurance. Müller advised governments to create the parameters and incentives for farmers to engage in climate-friendly and sustainable production.

Taras Kachka, Ukrainian Deputy Minister of Economic Development, Trade and Agriculture, explained that the COVID-19 pandemic and climate change are posing severe challenges to Ukraine. Despite this, the country will continue to pursue the goal of doubling its exports over the coming decade. To reach its export target, strategies will be developed, along EU guidelines, for irrigation, logistic systems and the use of inputs such as fertilisers

and pesticides. Organic farming will also be expanded in Ukraine and strategic partnerships with the EU will be stepped up in the areas of knowledge and technology transfer. Thomas Kirchberg, board member at Südzucker AG, pointed to the already-existing practice in the sugar industry of using all the remaining elements of the plant, besides the end product of sugar – such as water, fibre, and protein – and making sugar production as environmentally friendly and sustainable as possible. This includes the use of resistant plant varieties, developing a water and pest management strategy that saves on resources, as well as using alternative energy ideas on farms. As a representative of The Nature Conservancy, one of the largest environmental protection organisations in the world, Michael Wironen, TNC Center for Sustainability Science, talked about the importance of resilient soils within a regenerative food system. Better soil quality has a major impact on agricultural output and results in more nutritious food for humans. Wironen also emphasised that the challenges in the areas of food security, climate resilience and public health can only be overcome in a holistic system and with the use of innovative technologies.

Publications

Academic staff at IAMO publish their research findings in academic journals, monographs, anthologies and discussion papers. Increasingly they are also communicating them in short Policy Briefs. A complete list of publications can be found on IAMO's web site on the Internet

 <https://www.iamo.de/en/publications/complete-publication-list>

In the period covered by this report IAMO's publication activity continued to make progress yet again. This is particularly true of refereed articles with an impact factor, which are listed on the Science Citation Index (SCI) and the Social Science Citation Index (SSCI). The number of articles in 2021 with an impact factor rose 25 per cent in just one year to a new record of 80. All other publication categories for articles achieved record in 2021 too. There were a total of 113 articles in 2021, compared to an average of 83 for the three years 2018 to 2020. Articles in refereed publications numbered 96 compared to an average of 62 for 2018–2020. It is clear, therefore, that IAMO's internal quality management for publications continues to be effective.

IAMO Policy Briefs

 <http://www.iamo.de/publikationen/iamo-policy-briefs>

Since 2011, IAMO's research findings that are relevant to society have been published in the occasional IAMO Policy Briefs, which are kept short and written with the non-specialist in mind. They are particularly aimed at politics, business and the media as well as members of the public with an interest in the area. The following IAMO Policy Briefs appeared in 2021 and can all be downloaded as pdfs free of charge from the IAMO website:

- Prehn, S., Glauben, T., Loy, J-P. (2021): Looking into the futures markets: What are they really for? No. 39, Halle (Saale). (also available in German)

- Heigermoser, M., Glauben, T. (2021): Covid-19, unequal economic recovery and maritime food trade, No. 40, Halle (Saale). (also available in German and Russian)
- Ahmed, O., Glauben, T., Heigermoser, M., Prehn, S. (2021): With great power comes great responsibility: The EU and the Black Sea Region take leadership of the global wheat market, No. 41, Halle (Saale). (also available in German and Russian)
- Appel, F., Loewe, A. (2021): Research software - Sustainable development and support, No. 42, Halle (Saale). (also available in German)
- Djanibekov, N., Herzfeld, T., Arias, P.M. (2021): Food policy measures in response to COVID-19 in Central Asia and the Caucasus: Taking stock after the first year of the pandemic, No. 43, Halle (Saale). (also available in German and Russian)

IAMO Discussion Papers

 <https://www.iamo.de/en/publications/iamo-discussion-papers>

The series of IAMO Discussion Papers continued in 2021 with the following, which can be downloaded as pdfs free of charge from the IAMO web site:

- Hess, S., Koester, U. (2021): Die Bedeutung von Preisbeziehungen und Preisänderungen in ausgewählten Agrarmärkten [The significance of price relations and price changes in selected agricultural markets], IAMO Discussion Paper No. 194 (in German), Halle (Saale).

- von Cramon-Taubadel, S. (2021): Vertikale Preisbeziehungen - Beziehungen zwischen Erzeuger- und Verbraucherpreisen [Vertical price relations – relations between producer and consumer prices], IAMO Discussion Paper No. 195 (in German), Halle (Saale).
- Brümmer, B. (2021): Preisvolatilität auf Agrarmärkten [Price volatility on agricultural markets], IAMO Discussion Paper No. 196 (in German), Halle (Saale).
- Vollmer, T., Striewe, L., von Cramon-Taubadel, S. (2021): Forward- und Futuresmärkte und ihre Bedeutung für die Agrarpreisbildung [Forward and futures markets and their significance for agricultural pricing], IAMO Discussion Paper No. 197 (in German), Halle (Saale).
- Djanibekov, N., Herzfeld, T. (2021): The impact of COVID-19 on agrifood systems and rural areas in Central Asia and Caucasus countries: Final report of a study commissioned by FAO, IAMO Discussion Paper No. 198, Halle (Saale).

Studies on the Agricultural and Food Sector in Transition Economies

 <https://www.iamo.de/en/publications/iamo-studies>

In the series of publications Studies on the Agricultural and Food Sector in Transition Economies, IAMO publishes monographs and conference reports dealing with questions of agricultural economics in the countries of Central and Eastern Europe, as well as other transition countries. All publications from volume 22 onwards can be downloaded as pdf files for free from our website.

So far 32 conference reports or volumes and 65 monographs have appeared in the series. The publication in 2021 was:

- Uhl, K. M. (2021): Russian market power in international wheat trade and implications for global food security, Studies on the Agricultural and Food Sector in Transition Economies, Vol. 97, Halle (Saale).

Science communication

Not only does IAMO discuss its research findings on agricultural and food economics within the academic community, it also presents its findings to politics, business, NGOs and the wider public. In this regard the Institute regularly organises and takes part in high-ranking international events.



The **IAMO Forum** took place from 7 to 9 June 2021, with the title “Agrifood Systems in the Bioeconomy”. International experts from research, business and international

institutions gathered to debate the potential and innovations of the bioeconomy. The 315 participants discussed suitable development strategies in three plenary sessions, 13 parallel sessions, one panel discussion and a special session with industrial design students from Burg Giebichenstein University of Art and Design. Together with the International Bioeconomy Conference on 9 and 10 June 2021, the IAMO Forum 2021 formed the Bioeconomy Week Halle (Saale). The event was organised by IAMO's Structural Development of Farms and Rural Areas department, and financially supported by the German Research Foundation (DFG) and the Rentenbank. Cooperation partners were the Leibniz ScienceCampus Halle – Plant-Based Bioeconomy (WCH), the BioEconomy Cluster, the International Competence Center on Large Scale Agriculture (LaScala), the BioMonitor Project and the International Consortium on Applied Bioeconomy Research (ICABR). You can find detailed information here:

 www.iamo.de/forum/2021

As part of the **Global Forum for Food and Agriculture (GFFA)**, IAMO, together with the German Agribusiness Alliance (GAA) organised an expert panel discussion on the topic “How better to cope with change: New approaches for food system resilience to pandemic and climatic shocks”. The panellists from politics, business and academia talked about possible agricultural strategies under the difficult conditions of pandemics and climate change. The main focus was on how the challenges in agriculture – reduced rainfall, extreme temperatures, soil degradation – as well as regional and global crises, such as the COVID-19 pandemic, can be better overcome. The symposium was followed online by almost 500 people.

GFFA expert panel



IAMO also took part in the **Sino–German Agribusiness Conference** on 2 and 3 June 2021 on the topic “Approaches to Sustainable and Modern Agriculture” in Nanjing, China. As part of the 16th **Congress of the European Association of Agricultural Economists (EAAE)** IAMO organised a virtual pre-conference symposium entitled “Large Scale Agriculture in Transition and Developed Economies: Organizational and Societal Issues”. As a co-operation partner IAMO supported the 12th **Large Farm Management Conference (LFM)** on 9 September 2021 in Kyiv, Ukraine. On 22 and 23 October IAMO jointly ran the 4th **International Conference on “Natural Resource Management and Public Policy”**, which was hosted by Huazhong Agricultural University and the Center for Contemporary Chinese Studies at the University of Melbourne. Under the title “**Sustainable Agriculture and Rural Development II**” the Institute of Agricultural Economics Belgrade (IAE), in cooperation with IAMO, organized an international **scientific conference** in Belgrade, Serbia, which took place on 16 and 17 December. An overview of all events can be found here:

 <https://www.iamo.de/en/events/current-events>

Information on IAMO's research activity is disseminated via the Institute's own publications, press releases, articles in the newsletter, on IAMO's website and on social networks as well as in expert interviews in the media. In 2021 IAMO or researchers at the Institute were mentioned by name in a number of radio, print media and online reports. The following topics attracted particular attention:

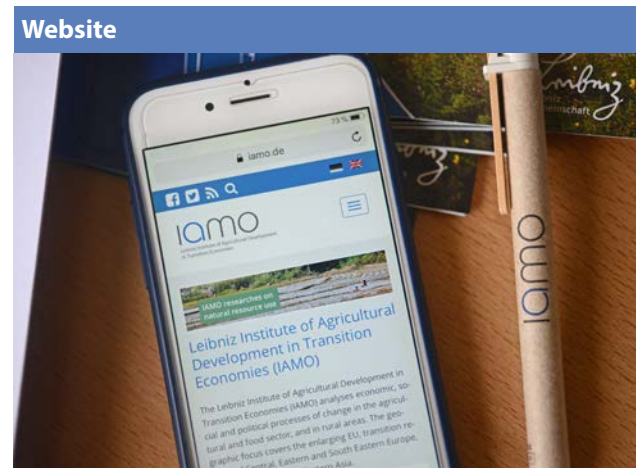
- Agricultural land markets
- The Saxony-Anhalt law on agrarian structure
- Future of the food sector
- Environmental protection and animal husbandry
- Green genetic technology
- Digitalisation in agriculture
- Food inflation in Russia
- Land rights in Central Asia
- Index-based agricultural insurance

A selection of articles in the press and specialist media can be viewed on our website at the section "IAMO in the media":

 <https://www.iamo.de/en/press/iamo-in-the-media>

The Institute's website  www.iamo.de/en and IAMO's Newsletter – both in German and English – regularly publish information on research findings, collaborations and projects, events, publications, support for young academics and awards. The electronic newsletter appears four times a year and can be subscribed to for free:  www.iamo.de/en/top-navigation/newsletter. Current Institute news can also be found on IAMO's social media pro-

files on Facebook  www.facebook.de/iamoLeibniz and Twitter  <https://twitter.com/iamoLeibniz>.





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Sources and picture references

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By car

Address

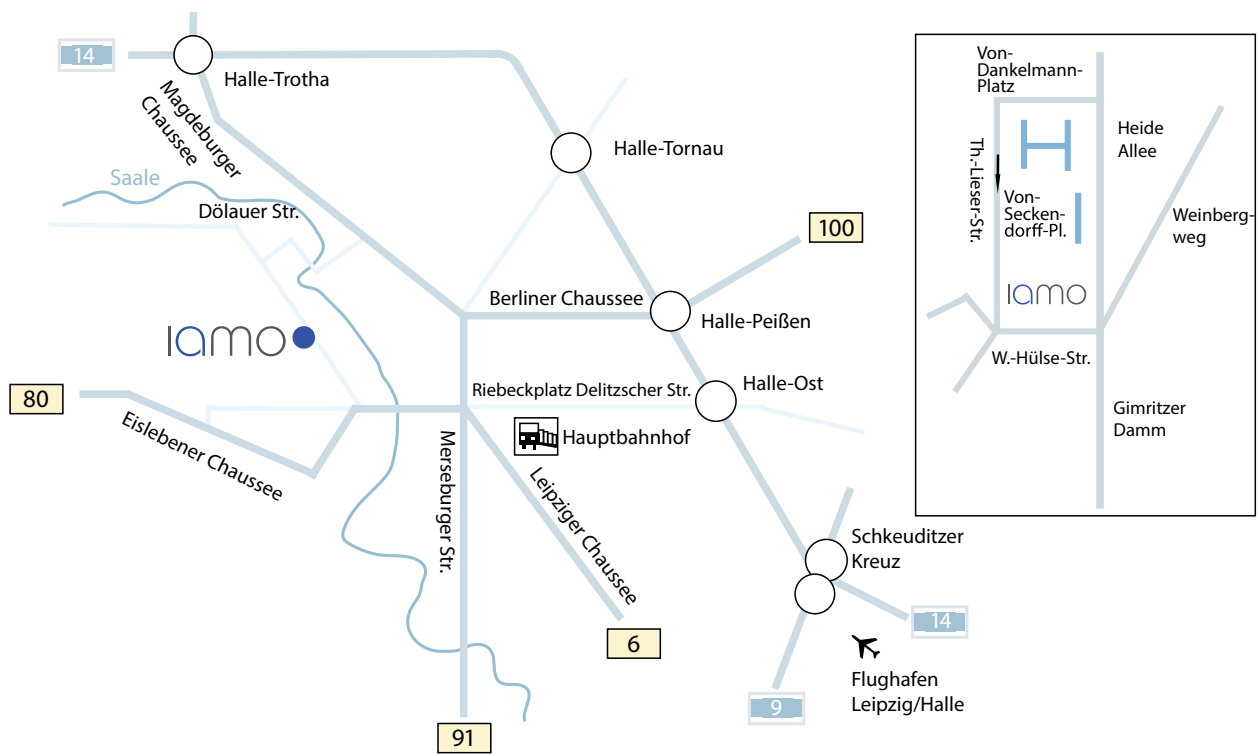
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By train

Exit the station via the main entrance and follow the signs to “Hauptbahnhof” stop. From there, take tram 4 towards Kröllwitz. Get out at “Weinberg Campus” (about 15 mins). The Institute is directly on your left in the direction the tram is going. – Alternatively, you can take tram 5 towards Kröllwitz. To do so, get on the tram at the “Hauptbahnhof” stop at the side entrance of the station building.

By plane

20 kilometres from Halle is Leipzig–Halle airport. A shuttle train runs regularly from the airport to the main train station. From there, see above.



Imprint

In addition to this annual, IAMO's publications include the Discussion Paper series, the Studies on the Agricultural and Food Sector on Transition Economies, the Institute's annual reports and the Policy Briefs.

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Cover photo Hay bales on a harvested field in front of a mountain landscape in Uzbekistan © Evgeniy Agarkov



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