Genetic Technologies in Agriculture as a Condition of Competitiveness and National Security in Post-COVID Period

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Abstract. The authors of the paper present the result of risk and perspective analysis of genetic technologies introduction into agricultural sector of national economies. In the context of high level mistrust in GMO, research results due to the interest of multinational corporations in obtaining ‘super profits’ and high potential of genetic technologies for national food security, it has been concluded that it is necessary to expand governmental overview powers and participation level in the development and introduction of GM technologies into agriculture and other spheres of economy in order to guarantee safety and ensure higher accessibility standards to the population. The results of the study are supported by the data of the survey among certain age groups of Russian, Egyptian, Bulgarian and American population conducted by the authors of the paper. As a solution, we suggest establishing a new Governmental Department related to the FAO GM foods in order to determine quantities, safety assessment standards and facilitate deals between countries enabling GM foods production. In the future, this may change the policy of some countries, which now have a strict ban on GMOs, allowing them to open up to genetic technologies development. There are both direct positive effects to the Government from support of research and introduction of genetic technologies in agriculture and indirect ones. They include new jobs creation, affordability of the market basket or commodity bundle, poverty reduction and national scientific potential increase. In the conclusion, it should be specified that the demand for genetic technologies in agriculture during the post-COVID period is justified due to decrease in living standards of global population, unemployment increase, change in production and consumption structure of national and world economy. Besides, a set of measures should be adopted aimed at implementing government policy of support and development of GM foods and services production at the global and national levels.

1. Introduction
In 2020, the world faced an unprecedented humanitarian crisis; COVID-19 pandemic being probably one of the worsts in human history regarding its impact on economy, society, lifestyle, food supply chains, making it the worst recession on record. Its influence on developing countries is significantly
greater than the seriously difficult situation in the developed industrial nations. Some countries have produced vaccines against COVID-19 and therefore expected to get out of recessions. However, in December 2020, the UK announced the detection of a new variant of SARS-CoV-2 and many countries made the decision to lockdown again [1-15]. These measures have long-term effect on national and global economies; economic recession is long lasting and the impact might be much worse than after the first lockdown especially after the announcement made by scientists that they still are not sure in the effectiveness of the vaccines against SARS-Cov2. Nevertheless, despite the fact that many nations saw the best economic growth on record after the first wave of pandemic, times are still hard, and global economy is not doing that well.

The Recession, the world is currently living in, needs proactive untypical solutions. The first two quarters of 2020 saw GDP falling sharply, or we risk it will take years to grow by small percentage. The third quarter of 2020 saw global economy growing again, meaning that the recession is technically over [12]. However, the complex dynamics triggered by the lockdowns intended to contain the disease are creating conditions for a major disruption to food systems, giving rise to a dramatic increase in hunger particularly in developing countries. According to recent estimates, between 83 and 132 million additional people, including 40-80 million low-income countries residents that depend on food imports, have experienced unfavourable situation in the food sector as a direct result of COVID pandemic (Torero, 2020) – will [2].

Twenty-five low-income countries, including Yemen, South Sudan and Lebanon risk considerable Food Safety decline because of the indirect social and economic consequences of the pandemic [13]. Latin American nations saw the amount of individuals requiring food assistance increased almost threefold in 2020 [14]. Food productivity may also be cut off in the future, especially if the virus is not restrained and isolation measures carry on [13]. In the long-term perspective, with global increase in unemployment and decline in household income, citizens’ food expenses will be prioritized. The share of household spending on food will continue rising, so will the cost of foods due to the disturbance in supply and the increased demand [15].

The authors conducted a survey to assess consumers’ perception of genetically modified organisms and suggested some steps and regulations that countries can apply to rebuild from current COVID-19 recession both in the nearest time and comprehensive long-term policies to boost growth. Under the circumstances, when the flexibility and adoptability of the current leading food systems are under tension both internationally and nationally, one of the suggested measures in the COVID-19 crisis is to reassess current agricultural practices and approaches to farming. Although, the ideas of drifting back to less ecological actions, of embracing novel nourishment technologies, including crop genetic modification, should be cautiously evaluated. The countries should also rearrange their priorities in the course of future budgets predation and see what can be done in technology race in the nearest time.

2. Materials and methods

The primary and secondary data were analyses in the course of the study, which enabled the examination of the situation with the spread and reintroduction of genetic technologies in some countries of the world. The authors have assessed the current trends that have intensified in the agriculture, particularly in the post-COVID period, including the growing role of farming in national economic security at the background of poverty increase and solving hunger issues, as well as disruption in national and global food chains:

- The primary data include the content and results of the survey conducted by the authors of the citizens, primarily of Russia and Egypt, aimed at identifying the level of trust/mistrust in genetic modification of crops and animals and the prospects for expanding the spread of genetic technologies in these countries, especially in the post-COVID period against the background of economic crisis, changes in the structure of production and consumption growing saving tendencies and secondary consumption as sectors of the sharing economy;
The secondary data include materials from the official websites of such international and national organizations involved in the development of genetic technologies, public opinion formation to meet the demand for GM foods and decision making in agriculture as World Health Organization, International Biotechnology Application Tracking Service (ISAAA), and National Academies of Sciences, Engineering, and Medicine (US).

The research methods included historical approach to the object of research, methods of quantitative statistical analysis, statistical survey of respondents, expert assessment, comparison and examination of feasible alternative choices.

3. Results
The authors conducted the online survey using Google Forms tool to see the consumers’ safety assessment of GM foods in comparison with conventional foods.

The survey started 13 November 2020 ending 25 December 2020 with 90 respondents from four countries including Egypt, Russia, Bulgaria and USA.

The Questions and Results can be presented as follows:

- Respondent's age groups included under 20 year-olds (35.6%), 21-30 years old (42.2%), 31-45 years old (14.4%), and 45-60 years old (7.8%); no one over 60 have submitted the survey. Since the largest share of 42.2 per cent among the respondents belongs to the most active in employment and life position respondents of 21-30 years old, they make up the most loyal and influential group of the population, given the prudent state policy they can influence the formation of positive public opinion on genetic technologies in agriculture;

- Respondent's Working Status was presented largely by University Student (61.1%), Service Worker (14.4%), Agriculture Worker (1.1%), Pensioner (1.1%), Managerial and professional occupations (8.9%), Unemployed (2.2%), Other (All submitted in Other work either in the basic education or higher education) (11%). The respondents included representatives of different social groups of Russian and Egyptian population but the majority of them are students who are the most sensitive to food prices fluctuation in terms of income proportion. The same category can be presented also by least socially protected population groups as pensioners and the unemployed. This allows us to assert that the further results of the survey in relation to the consumption of GMOs are reliable and take into account the respondents' solvency margin;

- Respondent's awareness of genetic modification of crops and animals (the question sounded ‘What do you know about GMO products?’) is presented as dangerous to humanity in 37.8 per cent of cases; useful as it solves the problem of hunger and contributes to availability of foods to everyone at a low cost (41.1%); 21.1 per cent of the respondents answered that they knew nothing about the subject;

- In the next part of the survey, the respondent's consumer behaviour under stable economic conditions and income was examined. The first question was about the choice between cheaper restaurant meal made from genetically modified foods and more expensive GM-free one. The respondents were asked: ‘You are at the restaurant and, after ordering, the waiter offers to choose between Normal and GM foods, the latter being 40-70 per cent cheaper. What will you prefer?’ 64.4 per cent of the respondents chose GM-free meal, whilst 35.6 per cent agreed to genetically modified one;

- Respondent's Buying Behaviour under moderate economic changes and price increase expectations was looked into. The participants were inquired: ‘You are at the restaurant and, after ordering, the waiter offers to choose between Normal and GM foods, the latter being 40-70 per cent cheaper. However, The Central Bank issued money and people say that all prices will increase at 10:00 and now it is 9:30. What will you prefer?’ The ratio was almost the same as in the previous question with preference to Normal Foods in 60% of cases and GM...
Foods in 40% despite the inflation expectations and the necessity of real income adjustment for depreciation amid rising prices and inflation. Comparison of the answers to questions 4 and 5 allows us to see how the respondents' opinion changes if the conditions for making decisions about choosing the type of food changed from normal, stable economic situation and fixed personal income to potential crisis development of economic factors with limited decision-making time and the onset of unfavourable economic conditions. The prevalence in favour of GM foods is quite small, but it indicates high elasticity of demand and correlation between the solvency margin and financial expectations of income or its depreciation in citizens and the willingness to make decision in favour of GM products.

The next question studied Respondent's Buying Behaviour under considerable economic changes and strong price increase expectations. The respondents were asked: 'You are at the restaurant and, after ordering, the waiter offers to choose between Normal and GM foods, the latter being 40-70 per cent cheaper. However, your country's economy is in severe recession and you do not know if you will get any income next month. What will you prefer?' The shift in consumer choice was observed when the respondents preferred GM foods in 56.7% of cases whereas 43.3% stuck to their previous choice of GM-free meal.

The Results of the survey have shown that in the groups with the unstable income aged under 30, who are either still studying, starting their career or unemployed, purchasing power is lower proving smaller choice options. The analysis of question 6 results has confirmed the conclusions made by the authors in answers to 4-5 questions. In the context of the global economic crisis, restructuring of the production and consumption of genetic technologies in agriculture will noticeably grow, which is important at the level of the national food policy of Russia, Egypt, and other global economies. Agricultural trade and agricultural exports are traditional budget revenue sources.

4. Discussion

According to the Apurva Sanghi, lead economist for the World Bank in Russia, there are short-term consequences of recession caused by the pandemic including real income drop, unemployment rise, weakened banking sector and lower fiscal revenues. One of the positive news is cautious macroeconomic policies and fiscal strategy as well as the accumulated buffer fund enabling Russian authorities to implement advantageous balancing regulations [16].

The World Bank experts note that if measures of Russian government are introduced appropriately they may to a certain extent contain poverty growth. However, short-term consequences could be accompanied by deeper longer-term impact with non-reparable losses such as deterioration of chronic health diseases, constant job and qualification deprivations, and small and medium business insolvency [3].

According to Federal Scientific and Technical Program for the Development of Genetic Technologies for 2019 – 2027, the government is working on applying some regulations and through these regulations in the short term (3-6 years) lines of agricultural plants (at least 4 crops) were created from the list of the main agricultural crops of the Russian Federation (wheat, potatoes, sugar beets, barley, etc.), obtained using genetic editing and characterized by improved economically valuable traits [8].

Russian economic growth was more positive than it was anticipated and showed 4 percent in 2020. If the announced vaccination program turns out to be effective, consumers and investment demand is likely to grow, so it is expected by the central Bank to ensure regular recoil to 2.6 per cent in 2021 and 3 per cent in 2022. However, further deterioration of Russian economic activity might be predicted if considerable increase in new pandemic cases occurs in the late 2021 with expected GDP growth by 0.6 per cent in 2021 and 2.8 percent in 2022 and consumers and businesses will be more deeply affected [16].

Russia bans the breeding of genetically engineered plants and animals without sufficient expertise and scientific studies for food safety reasons. However, Russian government simplified the import of
genetically modified soybeans until January 1, 2021, exempting them from state registration, if the safety is confirmed by the Rosselkhoznadzor [17-21].

Economic activity reduced because of the lockdown measures, temporary suspension of flight, and social distancing regulations. A large reduction in non-combustible private sector activity caused the decline to the lowest level of Purchasing Managers’ Index (PMI) to 38.3 per cent in April - June 2020. The employment rate increased to 9.6% from 7.7% the previous quarter showing 2.7 million individuals losing their jobs, particularly among unofficial employees, reported mainly in tourism, transport, construction, wholesale trade and retail.

The government allocated an emergency response package worth LE100 billion (1.7% of GDP) to augment health expenditure, scale-up social protection, and provide financial relief for individuals and businesses. Key measures included a one-off monetary grant to irregular workers and the expansion of existing cash transfer programs. In addition to subsidized credit for targeted sectors, the endurance measures were introduced in the form of delayed tax filing and loan repayments. The Central Bank of Egypt slashed policy rates by a cumulative 350 basis-points since March 2020 to ease liquidity. Inflation has been declining since end-2019 and has remained rather contained, registering an average of 5.7% in the fiscal year 2020 (from an average 19.6% in the previous three), reflecting subdued demand and the general decline of global commodity prices, including oil. [4]

In addition to the recession and the increasing unemployment rate, Minister of Electricity and Renewable Energy Dr. Muhammad Shaker announced the government's plan to restructure electricity prices in accordance with the plan to gradually lift subsidies until July 2021, with an increase of 19.1%, less than 21% last year [5].

If the pandemic persists through 2021, economic growth is expected to decline further to 2.3% with gradual rebounding in 2022. Consumers and investors’ behaviour in the short-term will stay constrained. Later on, poverty increase is prognosticated, especially among urban population. Inequality is expected to increase, as high-skilled, qualified formal economic sector work positions are relatively secured, while informal ones are considerably impacted by the pandemic [17].

Growing genetically engineered crops is currently not authorized in Egypt, there is no biosafety legal framework managing environment protection and commercialization. Egypt is interested in production of transgenic crops possessing resistance to biotic and abiotic stresses, especially drought and salt tolerance, leading to serious losses in economically valuable plants. In the pre-pandemic period. The Agricultural Genetic Engineering Research Institute studies biotechnologies available globally to solve issues facing agriculture in the country. The Egyptian government is moving toward privatization, transfer of technology to the private sector, which is interested in adoption of new technology for example, in vitro micro propagation of virus-free potato. However, until recently Egypt permitted GM crops only in GM cotton growing, overlapping GM crops friendly policy [18]. Despite the fact that Egypt lacks legislation regulating biotechnology, the government permits imports if the country-of-origin consumes these products for example import of 9 mln. metric tons of corn and 3.5 mln metric tons of soybeans in 2018. However, plantation of GM crops in banned [19].

In post pandemic period, the government have not adopted any measures toward applying or prohibiting the use of GM technologies in farming or importing them in order to improve food security.

In the middle of 20th century, it was proved that some genetic modification in the seeds can increase the yields by different percentages according to the type of the seed, but from the time of this proof till the earlier of the current century there were fears of GMOs with a lot of questions but after thousands of experiments to ensure that they have no risk on the human health.

“To date, no adverse health effects attributed to genetic engineering have been documented in the human population.” National Research Council (2004).

“Indeed, the science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe.” American Association for the Advancement of Science (2012).

“Bioengineered foods have been consumed for close to 20 years, and during that time, no overt consequences on human health have been reported and/or substantiated in the peer-reviewed
literature.” – Council on Science and Public Health of the American Medical Association House of Delegates (2012) [22].

“[Genetically modified] foods currently available on the international market have passed safety assessments and are not likely to present risks for human health. In addition, no effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved.” World Health Organization (2014) [6].

Klumper and Qaim (2014) analyzed findings of 147 studies of HR soybean, maize, and cotton and Bt maize and cotton in 19 countries. They found that profit increased by an average of 69 percent for adopters of those crops, largely because increased yields (21.5 percent) and decreased insecticide costs (39 percent). Another meta-analysis of findings of studies of the same crops in 16 countries reported that production costs were greater for GE varieties than for non-GE varieties but that gross margins were higher on the average for the GE varieties, in large part because of their greater yields (Areal et al., 2013). Raney (2006) reviewed studies conducted in Argentina, China, India, Mexico, and South Africa and concluded that GE cotton, maize, and soybean provide economic gains to adopting farmers in these countries; however, the effect was highly variable and depended on national institutional capacity to help poorer farmers to gain access to suitable innovations [7].

FAO (Food and Agriculture Organization of the United Nations) until now has no serious and clear advance towards the GMO with taking in consideration it may solve the problem of hunger saying “FAO does not interfere in the policies or decisions, including those related to GMOs, of its Member Governments and so it has no position regarding the development, testing or commercial release of GMOs in any specific country. However, on their request, FAO provides advice, assistance with capacity development, information and a meeting place to its Member Governments” [10].

Recently FAO launched an online platform for only sharing information about the safety of GM Food [11]. The points below present how the FAO GM Department should be:

- FAO in the next period of time take a serious step to solve a potential problem which may happen after ending Coronavirus which is the acute shortage of food commodities all over the world by establishing a new department just specifies in the GMO Food which may be called GMO Department, this department should exist in every country in the world [23];
- The country is responsible for the genetically modification process on the seeds through its laboratories and the country should build more laboratories to get the quantities demanded in the nearest time and that will create several job opportunities;
- The GMO department should supervise the genetically modification process to ensure the safety of the seeds;
- The GMO department should supervise on the buy and sell process inside the country (that’s not considered an interference in the country's internal affairs, it’s just for preventing any government from exploiting opportunities and make high profits);
- The GMO department should supervise on the international trade included any GMO product for safety assure;
- The people who buy GMO seeds should return a very slight percentage of their yield (ex: 0.001%) to reduce the cost of the genetically modification in the laboratories and the laboratories will extract the seeds from the fruits and this percentage is constant till quantitative constancy demanded occur and get efficient equilibrium point;
- The top-level managers of each country shouldn’t have the nationality of the country to prevent fraud;

5. Conclusion
In that research, the Authors showed the situation on the development and implementation of genetic technologies in agriculture in comparison between Egypt and Russia through seeing what is the economic situation for each country and how do they treat with the GMOs.
International organizations like (WHO, American Association for the Advancement of Science, etc.) report that the GMOs are safe and there is no any complain from a human about them until now and according to some farmers who used the GMOs their economic status improved.

The result of survey can to see that people can accept the GMO foods in the current situations (the recession in economy and their low financial status) and a higher percentage of the people how submitted the survey can accept the GMOs instead of the normal food because we have of the low price of the GMO foods.

The Authors suggests some regulations like establishing the GMO Department which is a main part of FAO to organize the usage of the GMOs around the world to avoid the corruption of the governments.

Government should be involved in implementation of GM technologies in agriculture in order to guarantee the reliability of studies on GMOs safety, quality and life expectancy, etc. On the other hand, state regulation of GM technologies R&D makes these developments attractive for investment and ensures the growth of competition for agricultural products in the domestic and global markets.

All proposals suggested in this research either through national or international institutions in Agriculture and Energy are to shift the poor economies from suffering from not being able to provide the simple primary needs to the first step of growing the economies and to make progress in the other fields.

If the advanced countries use these regulations, they may accelerate the progress in the economies and science, but it may be a political weapon by sending the aids (GMO products including foods, clothes, etc) to the poor countries and that may affect decisions of these countries among the neighbouring countries in the political issues.

The consumption and production structure of national and global economies in the post-COVID period has noticeably changed: against the background of a sharp decline in traditional services and entertainment sector, digital services, sharing economy segment, together with a noticeable decrease in solvency margin of the middle class, and poverty increase. The consumption structure has also changed in favour of the food basket and the ability to provide citizens with affordable food.

Russian example of traditional price growth at the end of the calendar year can no longer be explained only by factors of seasonality or energy prices increase. Threats of losing the planned entrepreneurial tax income and reduction in the consumption behaviour of many goods and services lead to a high rise in prices, inflation which means that the potential of GM technologies in agriculture is an important condition for a sustainable food policy.

Government framework of development and use of genetic technologies should also apply to introduction of training personnel programmes involved in GMOs production, for example, new careers as GM agronomist, and to educational public campaign for citizens of different age groups in order to convey relevant information about the safety and benefits of GMOs for agriculture and consumption in general.

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