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Environmental aspects of resuming civil airport functioning in Ukraine

The analysis of potential environmental issues of restarting civil airports operations was conducted. A disproportionally high effect on local biota and population is an expected problem, calling for the development of preparatory action plans.

Introduction.

The onset of the full-scale war in Ukraine led to decline in many branches of economy, including transport. However, this negative effect was not the same for all modes of transportation and on a timescale it demonstrated dramatic changes.

According to the data from official reports of the Ministry of Infrastructure before 2020 Ukrainian aviation had demonstrated stable increase by 7-10% in all sectors, both domestic and international. The Covid-19 crisis led to major changes in the face of the Ukrainian aviation industry. In particular, market shares and major players on the market have changed and the pan-European trend of the low-cost companies' expansion has progressed to Ukraine as well. This expansion is achieved through the increased frequencies on many routes inside the European continent and by taking over the assets of companies that have gone bankrupt or downsized.

After banning civil aviation flights railroads have picked up cargo and passenger traffic from the air transportation. These have also resulted in shifting environmental effects from civil aviation to rail and road transportation. This, however, wasn't symmetrical change.

From one side, aviation is among the major polluters of the environment and cutting its operation would bring multiple benefits to the environment. From the other side, the general tendency of aviation development over the last 20 years was growing concerns about the need to reduce environmental impacts. Considerable achievements were demonstrated towards the reduction of greenhouse emissions and noise levels mitigation. Rail and road transportation weren't so successful in cutting emissions and other negative environmental externalities. Thus, we observe disproportional increase of the pressure on the environment from railway and road transport, which is higher than the volume produced by the same units of air transportation.

So, the question is what to expect in terms of the effects on the environment if civil air transportation is to resume.

Environmental effects of airports.

In a broad perspective, volumes of transportation, number of flights, type of aircrafts and airport/airlines characteristics will define the intensity of environmental pressure (Greer et al., 2020). But in case of restoring the whole branch the effects are hard to count and predict, since the exact characteristics of airlines are not known and aggregated or expected instead of site specific.

Grampella et al. (2020) have conducted the analysis of the Italian airports and concluded that total airport activities, and fleet characteristics, in particular size and age, are directly related to environmental effects from an airport activity:

- A +1% in movements yields a +1.05% in total environmental effects.
- A +1% in aircraft size gives rise to a +1.8% in total environmental effects.
- A +1% in aircraft age generates a +0.69% in total environmental effects.

Thus, the complete reestablishment of airport operations would definitely lead to a wide range of effects, many of which are predictable. Increasing emissions from aircrafts and ground operations will add to the ambient air pollution, but this will be coupled with the reduction of pollution generated by other modes of transport. At the same time, aviation is a known contributor to greenhouse emissions, calling for revision of the country limitations to meet the state obligations in the field.

Field operations will be re-established and many additional work and renovation are to be conducted to compensate for ageing, wearing and degradation of equipment. The budget and labour investments in renovation and will, in turn, depend on the overall financial situation in post-war country and thus define the fleet structure: lack of budget potential might set restrictions on the type and age of aircrafts, thus, potentially open the way for aged aircrafts, which have high specific emission characteristics. Apart from ground air pollution such old equipment is prone to leakages and other forms of losses, turning into soil and natural water bodies.

Operation of airports is characterized by intensive externalities and population living in close proximity to these facilities have adapted to the levels of their technogenic pressure. As a result, after resuming flight will initiate stress reaction among local population and a period of adaptation to basically new aspects of living environment will follow.

Physical pollution from the airport area is not limited to noise, since electromagnetic fields from civil aviation facilities are among the most serious impacts on the environment. Regulations of this factor cover mostly working area and thus do not account local residents. This should be accounted among the drivers of medical situation at the impact area of airports.

Potential interactions between avian fauna and airports after the restart of operations.

A separate field of concern, often omitted in airport impacts assessment, is biota of the area, in particular, avian fauna.

Birds typically use airfields and neighbouring zones as their forage areas. With the pace and patterns of urbanisation birds are forced to adapt to various artificial facilities, going through the process of synanthropization. Having left their natural habitat they are not able to settle back due to occupation of their niches by competitors in wild. Various researches show that many species seem to be especially drawn to airports and surrounding areas in terms of nesting, foraging, resting and breeding, for reasons that remain understudied and largely speculative (Chen et al., 2021; Castro-Vásquez et al., 2022). For these reasons both birds and aircraft suffer the consequences of additional competition in the airspace, leading not only to potentially negative environmental outcomes, but also economic ones. This problem is mostly considered from the perspective of flights safety and is still poorly covered by both airport management and ornithologists (Cheng et al., 2022; Hu et al., 2020).

Considering the perspectives of flights resume in Ukrainian airports, a more serious problems is raised. The thing is that over the last few years the Ukrainian airfields and adjoining territories were literally free from aircrafts and their noise, thus

turning into attractive and relatively safe habitat. As such they are inhabited now by numerous species, even those which are not usually present at man-made landscapes. So, aircrafts on flight will definitely encounter much bigger density of birds, which increases the risk of collisions and fatalities among birds and damage to passengers and equipment. Moreover, the period of limited illumination, minimal noise and movement at night created favourable conditions for growing density and diversity of urban fauna in general and at the airports area in particular. With such background re-launch of civil aviation will be a serious threat for avian and other population, which have adapted to stable and relatively safe areas of aviation enterprises. If this is combined with environmental pollution from activated airport activity, we expect dramatic decline in number and composition of airport communities to the extent that may threaten their survival.

Conclusions. Bringing civil aviation back to Ukrainian airports is a positive and awaited event. However, it needs careful considerations and assessment of potential environmental issue to be risen. Management of airports must invest efforts in developing preparatory actions to mitigate possible detrimental effects on local population and animal communities.

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