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Livestock production as a potential for international trade exchange, the case of the Republic of Croatia

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Abstract

The key feature of the current international trade exchange of livestock, meat, and meat products in the Republic of Croatia is the relatively high and growing foreign trade deficit. In order to overcome the negative economic trends and improve the situation, it is essential to find new or revitalize existing markets, which is crucial for overcoming various weaknesses in international trade. Through an integrated approach that includes sustainable resource management, the introduction of new technologies, and production inputs, it is possible to create the conditions necessary to improve the situation in international trade flows. Therefore, this paper will analyze trade components, imports, and exports of livestock as economic categories during the period from 2019 to 2023. The methodology used in this paper will include calculations for import coverage by exports, relative import coverage, expressed comparative advantage, calculation of the relative foreign trade balance, and statistical trend analysis. The aim of this paper is to present the trade of livestock, specifically pigs, cattle, sheep, and goats, through international trade flows, i.e., imports and exports, to show the trade balance, and, through trend calculations, project the trade exchange for the next five-year period.

Key words: livestock production, international trade, imports, exports, trade balance

INTRODUCTION

Land as an economic good represents the fundamental resource of agricultural production. Economic goods are scarce because their availability is limited compared to human needs; thus, they are items or services that are both desirable and limited. The definition of economics refers to the most efficient use of resources, i.e., achieving the best possible allocation of resources, which implies that economics addresses two key issues (Krugman, 2009): resource scarcity and choice (economic decision-making). The problem of scarcity manifests as a persistent gap between fulfilled and unfulfilled desires, which economic progress may mitigate but never completely resolve. The scarcity of goods and services, which satisfy numerous needs and aspirations, arises from the limited availability of resources. Consequently, the treatment of scarce resources and the issue of choosing among alternative uses of these resources highlight economics as the science of rational choice. This discipline identifies and refines the principles governing rational economic behavior (Olson et al., 2009). Decision-making in the selection process requires comparing benefits and costs, revenues and expenditures, and costs and profits. The principle suggests that the benefits of a given choice should exceed its costs, thereby improving an individual's economic position. The selection of production largely depends on the availability of natural resources and associated costs. The allocation of labor, capital, and technology influences the choice of input combinations. Modernizing business processes enables higher output levels with lower investments and reduced labor engagement (Simić et al., 1999). The application of contemporary technology and more productive labor allows for an increased production volume and effective market placement. Enhanced productivity in agriculture leads to a greater food supply offered at lower market prices. The concept of

"cheaper and higher-quality production" becomes imperative in achieving market competitiveness as the ultimate goal (Bošnjak et al., 2003). These activities can be consolidated under the term economic efficiency. Economic efficiency is utilized when evaluating the production of a single unit of output, where production is considered economically efficient if it is achieved at the lowest possible cost. Economic efficiency depends on the cost of production inputs. A fundamental understanding of this concept lies in recognizing that economic efficiency occurs when production costs for a given output quantity are minimized (Arsenović et al., 2002). A defining characteristic of Croatian livestock production is the small average farm size and low productivity, which may be the primary cause of overall inefficiency in domestic livestock production and reliance on imports of both live animals and animal-derived products. To enhance competitiveness, it is necessary to expand livestock production and improve the efficiency of resource allocation, including land, labor, and livestock traditions (Popović et al., 2009).

With Croatia's accession to the European Union, the Croatian livestock sector has gained easier access to international markets. International trade flows play a significant role in economic development. No economy can base its growth solely on self-sufficiency in real and financial resources, making international trade indispensable. The overall balance of international trade influences growth rates and key macroeconomic variables (Krueger, 2009). The importation of specific goods and services negatively affects a country's trade balance, necessitating financial resources for coverage, increasing debt, altering exchange rates, and impacting domestic inflation through imported product prices (Bjelić, 2008). Conversely, exports stimulate domestic resource employment, provide financial resources without increasing debt, and generate a series of additional benefits within the national economy (Blanchard, 2005). The importance of trade flows in economic conditions underscores the necessity of quantitative measurements of international trade in goods and services. The results of such analyses provide valuable insights for economic policymakers (Kovačević, 2002). Quantitative assessments of trade flows and their implications for other economic variables can be performed using statistical tools. International trade in goods represents the most significant component of global trade, accounting for over 80% of total world trade.

International trade plays a crucial role in enabling surplus products to be placed on global markets while compensating for shortages through imports. It allows for achieving more favorable prices compared to selling exclusively on the domestic market, expands the assortment of products and services, and improves the quality of human needs satisfaction. Additionally, it directs producers towards applying global evaluation criteria and standards in production and adopting the most advanced technological processes. Continuous communication with international markets positively influences workforce training, knowledge expansion, and familiarity with different cultures and traditions (Stojadinović et al., 2012). Agriculture is an economic activity that encompasses livestock and crop production, along with other related services. It can be seen as a subsistence practice, where farming ensures food production sufficient for the needs of the producer and their family, or as a commercial enterprise aimed at generating financial profit through land cultivation. In developing economies, agriculture plays a key role in establishing sustainable economic growth, as its development stimulates non-agricultural sectors, increases employment, and improves living standards. Maintaining agricultural activities in rural areas is of great importance, as agriculture remains the primary land user, a producer of food as a strategic resource, and a source of livelihood for a significant portion of the rural population. Consequently, it has a dominant influence on sustainable rural development, environmental protection, and biodiversity conservation. Rural development policies should ensure an integrated approach to addressing challenges and provide effective solutions for the advancement of the agricultural sector in rural areas (Bašić et al., 2002).

The standard trade model is based on key economic relationships, including the production possibilities frontier and the relative demand curve, the relationship between relative prices and demand, the determination of global equilibrium based on world relative supply and demand, and the impact of terms of trade on national welfare (Krugman, 2009). A country's development strategy should begin at the local level, with a comprehensive approach to rural development through investments in innovation, modernization of technology and equipment, strengthening local producer associations, and improving the placement of agricultural products. These measures benefit both producers and consumers by

enhancing the competitiveness of farmers and the quality of life in rural areas while also improving food safety and consumer protection (Defilippis et al., 2005).

Based on this theoretical framework, the study aimed to analyze the trade of livestock, specifically pigs, cattle, sheep, and goats, within international trade flows, including imports and exports. Additionally, it seeks to assess the trade balance over time and use trend calculations to project livestock trade for the next five years.

MATERIAL AND METHODS

Cross-border livestock trade in Croatia has been monitored for many years and is subject to variations in import and export ratios. The import of livestock into the country requires various written approvals and certificates related to product quality. As the global economy develops, research indicates a growing market demand for livestock and meat products. Data on livestock imports from 2019 to 2023 are presented in the following table.

Table 1. International Trade Exchange of Arable Crops in tonnes (2019–2023)

Live animals	2019		2020		2021		2022		2023	
	export	import	export	import	export	import	export	import	export	import
Pigs	12.36	19.77	35.35	41.40	41.92	43.16	46.88	47.76	51.26	53.13
Cattle	27.06	35.42	46.25	49.37	57.23	58.58	66.12	56.51	62.81	60.28
Sheep	14.02	18.71	10.33	11.82	13.35	9.20	19.35	24.15	15.34	29.31
Goats	17.35	25.98	9.14	12.15	13.41	10.12	21.26	22.87	17.86	32.02
Total	70.79	99.88	101.07	114.74	125.91	121.06	153.61	151.29	147.27	174.74

Source: Prepared by the author based on data from the Croatian Bureau of Statistics

According to statistical data on the movement of goods in international markets, the ratio of live animal imports and exports varies from year to year. Live animal production was efficient only in the year 2021 and 2022, when a positive trade balance was recorded. Given the existing potential, agricultural policy measures should be directed toward achieving better market competitiveness. The methods used in this study include the calculation of import coverage by exports r_{ij}^{t}, the calculation of relative import coverage by exports (RPU), revealed comparative advantage (RCA), and the relative trade balance (RVS). Import coverage by exports is calculated as the ratio of exports of sector *i* section *j* to the imports of sector *i* section j in the same country in the observed year t, following the equation (Babić et al., 2003):

$$r_{ij}^{t} = \frac{X_{ij}^{t}}{ij} x\ 100$$

r_{ij}^{t} - import coverage by exports in year *t*
X_{ij}^{t} - exports of sector and section j in year *t*
M_{ij}^{t} - imports of sector and section j in year *t*
$t \in [2019 – 2023]$

The indicator of the relative competitiveness of a sector (or section) in total exports and imports is represented by the relative import coverage by exports coefficient. It is calculated as the ratio of exports and imports of goods from sector and section j to the ratio of total exports and imports of goods from sector and section j in the same country in the observed year t, following the equation (Krugman, 2009):

$$RPU_y^t = \frac{\frac{X_{ij}^t}{M_{ij}^t}}{\frac{\sum_{i=1}^{n} X_{ij}^t}{\sum_{i=1}^{n} M_{ij}^t}} x\ 100$$

RPU_y^t - relative import coverage by exports in year *t*
X_{ij}^t - exports of sector *i* section *j* in year *t*
M_{ij}^t - imports of sector *i* section *j* in year *t*
$\sum_{i=1}^{n} X_{ij}^t$ - total exports of sector *i* section *j* in year *t*
$\sum_{i=1}^{n} M_{ij}^t$ - total imports of sector *i* section *j* in year *t*
t ∈ [2019 – 2023]

The concept of comparative advantage explains the ability or potential of a country to compete with the rest of the world in the export of its products, compared to the same (homogeneous) products. The indicator of the revealed comparative advantage of a sector in total exports is represented by the RCA coefficient. It is calculated as the ratio of exports of product and country j to the exports of all products from country j, compared to the same ratio of world exports in the observed year t, following the equation (Babić et al., 2003):

$$RCA_{ij}^t = \frac{\frac{X_{ij}^t}{X_{iw}^t}}{\frac{\sum_{i=1}^{n} X_{ij}^t}{\sum_{i=1}^{n} X_{iw}^t}}$$

RCA_{ij}^t - revealed comparative advantage in year *t*
X_{ij}^t - exports of product *i* country *j* in year *t*
X_{iw}^t - exports of product *i* all countries in the world in year *t*
$\sum_{i=1}^{n} X_{ij}^t$ - total exports of all products from country *j* in year *t*
$\sum_{i=1}^{n} X_{iw}^t$ - total exports of all products from all countries in the world in year *t*
t ∈ [2019. – 2023.]

Finally, the analysis of commodity sectors was conducted based on the comparison of net exports. The ratio between exports and imports (net exports) and the sum of total exports and imports gives the relative trade balance (RVS) in year t. It is calculated using the following equation (Krugman, 2009):

$$RVS_i^t = \frac{X_i^t - M_i^t}{X_i^t + M_i^t}$$

RVS_i^t - relative international trade balance of sector *i* in year *t*
X_i^t - exports of sector *i* in year *t*
M_i^t - imports of sector *i* in year *t*
t ∈ [2019. – 2023.].

The mentioned indicator can take positive or negative values, which will be explained through the research results. Using the trend calculation method $y_i = b_0 + b_1 \cdot x_i + e_i$; where $i = 1, 2, \ldots, n$, the trend of the import and export relationship of livestock in the future 5-year period will be shown.

RESULTS AND DISCUSSION

By applying the mentioned methods, results have been obtained and graphically presented. The obtained results refer to the period from 2019 to 2023.

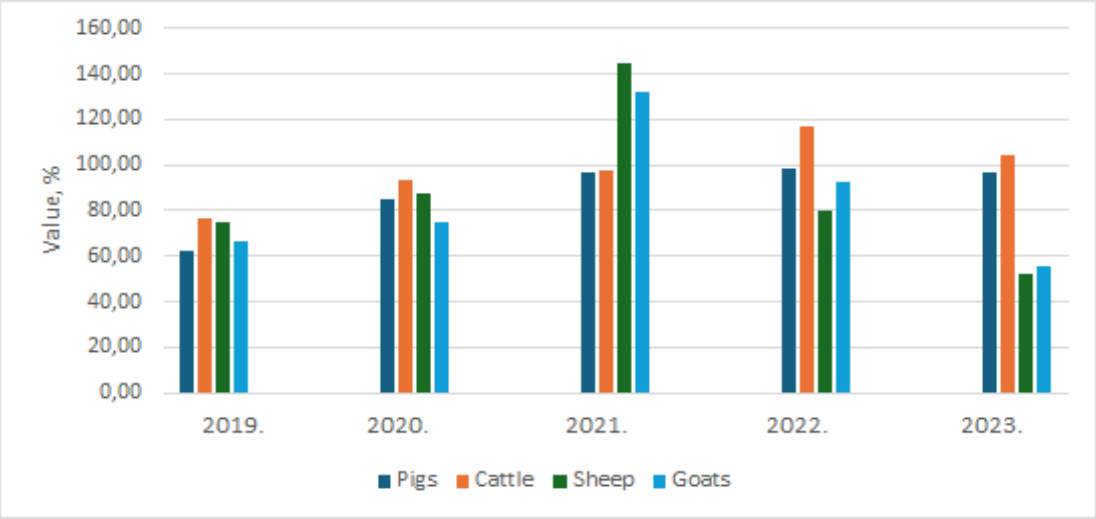

Figure 1. Representation of import coverage by exports and relative competitiveness of the sector
Calculation by the author based on data from Table 1 and the Croatian Bureau of Statistics

The agriculture sector is of strategic importance to the Republic of Croatia. Positive values (above 100) in international trade were recorded in the sheep and goat sector in 2021, in the cattle sector in 2022, and again in the cattle sector in 2023. However, for most of the analyzed period, the values were negative, indicating a need for intervention in agricultural policy. Specifically, these values are below 100, which suggests the need for improvements in the competitiveness of agricultural sectors in Croatia.

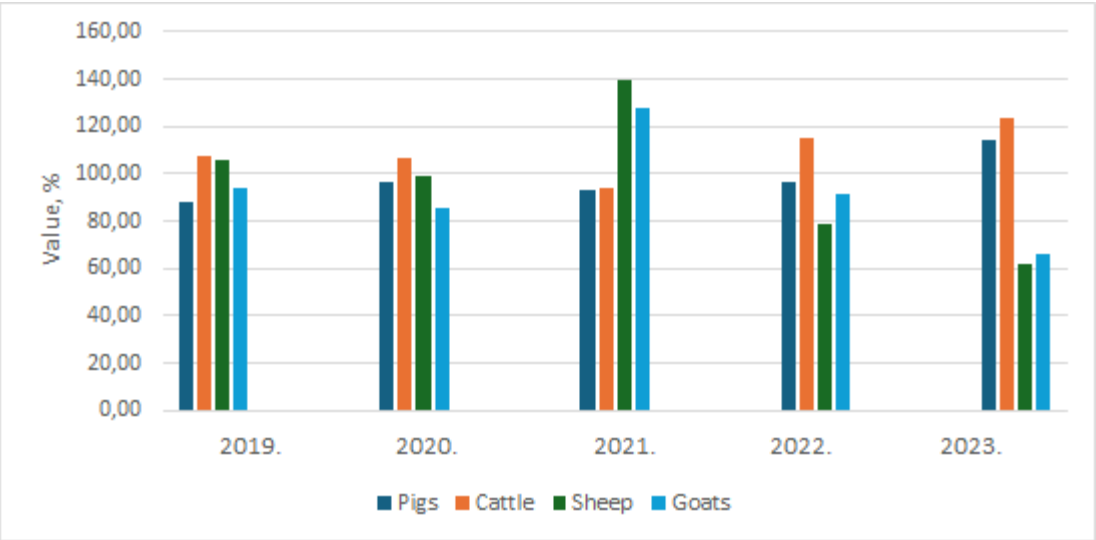

Figure 2. Relative import coverage by exports
Calculation by the author based on data from Table 1 and the Croatian Bureau of Statistics

The data show that values above 100 in international trade in 2019 were recorded for cattle (107.80) and sheep (105.72), for cattle in 2020 (106.35), for sheep (139.52) and goats (127.41) in 2021, for cattle

(115.24) in 2022, and for pigs (114.48) and cattle (123.63) in 2023. The higher the Relative Coverage of Imports by Exports (RPU), the greater the ratio of coverage in relation to total imports and exports. Sectors with higher RPU values show a more favorable export-to-import ratio and can be considered leaders in export expansion (Grgić, 1983).

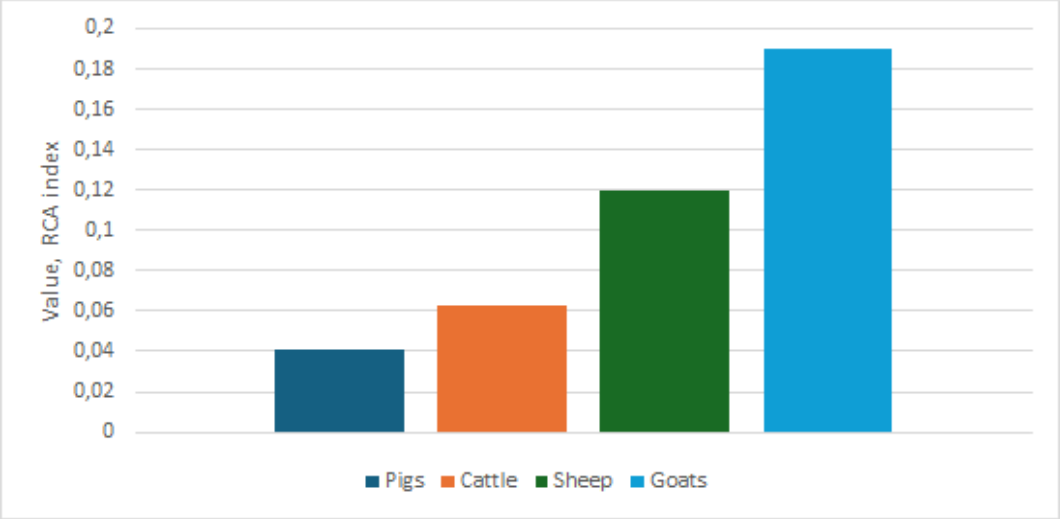

Figure 3. RCA index values of comparative advantage in international trade
Calculation by the author based on data from Table 1 and the Croatian Bureau of Statistics

The values in the chart show the RCA index values. The highest RCA index values in international trade are for goats (0.19), followed by sheep (0.12). Cattle and pigs have significantly lower index values, 0.06 and 0.04, respectively, indicating a lower comparative advantage, or weaker economic strength in livestock production. In other words, the livestock sector in Croatia operates with higher costs than similar sectors in other countries.

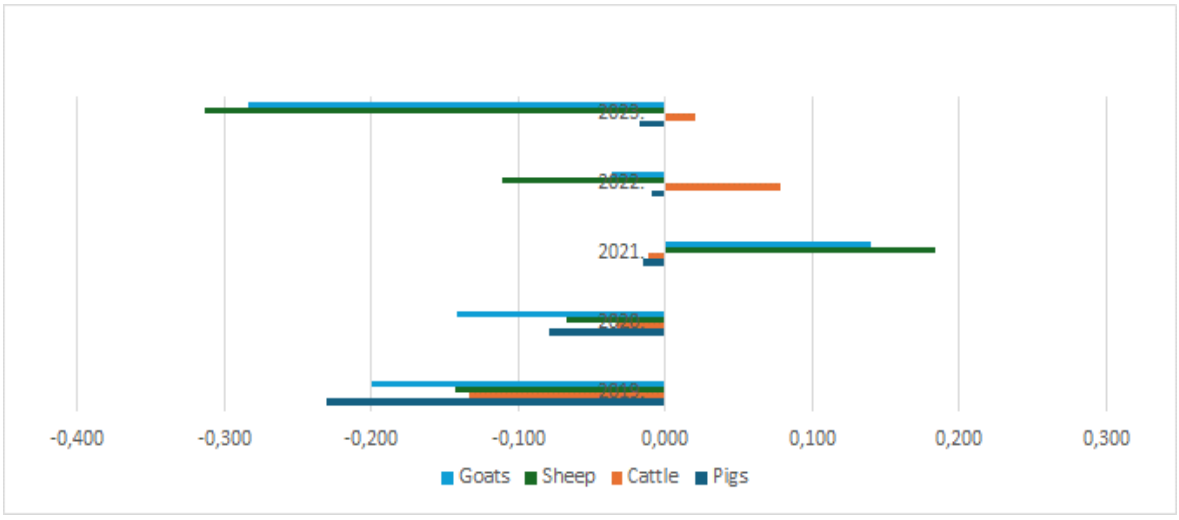

Figure 4. Relative international trade balance
Calculation by the author based on data from Table 1 and the Croatian Bureau of Statistics

Most of the analyzed commodity sectors show unfavorable results in terms of the relative export-to-import ratio. The worst result was recorded in 2023 for the sheep sector (-0.31), goats (-0.28), and pigs (-0.02). In 2019, all four sectors recorded negative values ranging from -0.13 to -0.23. Based on the previous import data for pigs, cattle, sheep, and goats, a trend chart has been created for the next five years, specifically for the period from 2024 to 2028.

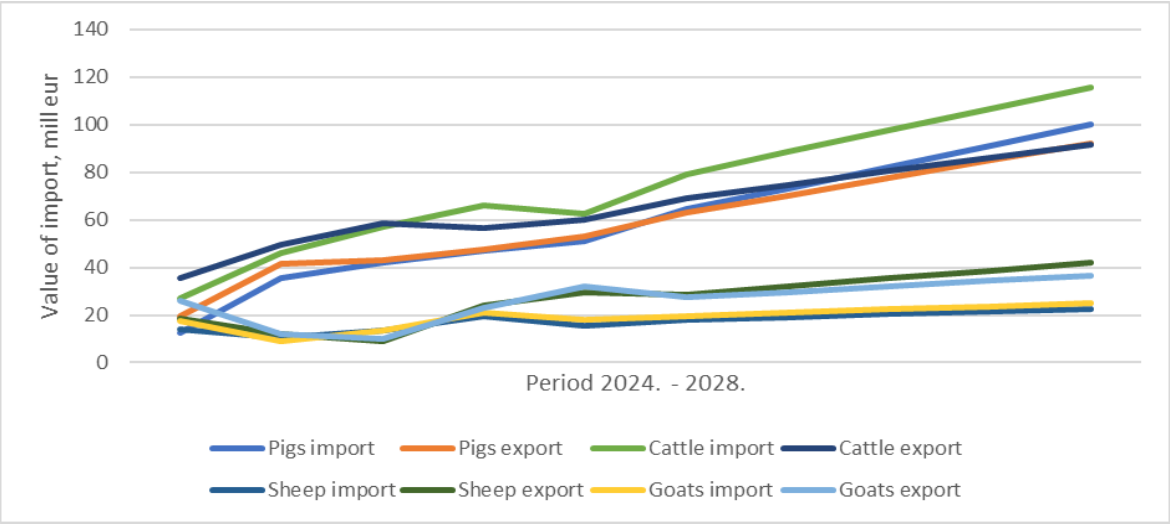

Figure 5. Movement of imports and exports in the current period and the trend for the future period
Calculation by the author based on data from Table 1 and the Croatian Bureau of Statistics

According to the data from the figure 5, all curves follow an upward trajectory, meaning that an increase in the import and export volumes of all sectors is expected, which should result from higher production volumes. Furthermore, it is anticipated that by 2028, there will be a positive trade balance in international trade for pigs, cattle, and goats, while the trade balance for sheep is expected to remain negative.

CONCLUSION

This study aimed to analyze the international trade of pigs, cattle, sheep, and goats, focusing on the relationship between imports and exports, in order to determine the trade balance and forecast the expected livestock movement for future market exchange. The results of the study showed that, although the agricultural sector is of strategic importance to the Republic of Croatia, positive values (above 100) were recorded in the trade of sheep and goats. Furthermore, regarding import coverage by exports and the relative comparative advantage of the sectors, the results indicated that, during the analyzed period, sheep and cattle production were considered key drivers of export expansion. However, the share of comparative advantage in international markets for all sectors is extremely low, despite the substantial potential for the development of livestock production.

In terms of assessing the relative trade balance, most of the analyzed commodity sectors showed unfavorable results. Nevertheless, the trend calculation indicated that, in the next five-year period, an increase in production volume is expected, which will likely be reflected in a positive balance in international trade for pigs, cattle, and goats. For the sheep sector, a negative balance is forecasted. While market liberalization and deregulation have created substantial business opportunities, they have not significantly boosted domestic supply in the analyzed sectors.

A key feature of Croatia's international trade is the trade and current account deficit, which points to the high external vulnerability of the livestock sector in Croatia. Therefore, it is essential to develop a strategy for the growth of livestock production to realize the anticipated forecasts. Based on the analysis of the trade flows for pigs, cattle, sheep, and goats, the calculated parameters, and the forecasted trade trend for the next five years, it can be concluded that the set objectives have been achieved.

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