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Possibilities for Applying the Pony.ai Model in the Republic of Serbia: The Potential Development of an AI Data and Testing Hub

Abstract: *This paper examines the possibilities of applying elements of the business and development model of Pony.ai in the context of the Republic of Serbia, with a particular focus on the development of an AI data and testing hub as an alternative development pathway. Starting from the fact that Serbia no longer possesses a developed automotive manufacturing industry, the analysis focuses on those components of the Pony.ai model related to data collection and processing, testing and validation of artificial intelligence–based systems, as well as the role of the institutional and regulatory framework in enabling such activities. The study adopts a qualitative research approach based on the analysis of relevant academic literature, international reports, and regulatory frameworks, complemented by a case study of Pony.ai as a representative example of an AI-intensive model. Special attention is given to the economic and institutional characteristics of the Republic of Serbia, as well as to the barriers arising from regulatory complexity, limited access to capital, data availability, and integration into international AI ecosystems. The findings indicate that the transfer of elements of the Pony.ai model does not imply a direct replication of an industrial approach, but rather a selective and adapted application through the development of AI data and testing activities compatible with Serbia's existing economic and institutional capacities.*

Keywords: *artificial intelligence, Pony.ai, AI data and testing hub, institutional framework, economic development, Republic of Serbia.*

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INTRODUCTION

The development of artificial intelligence (AI) over the past decade has become one of the key drivers of structural change in contemporary economies. The impact of AI technologies extends beyond purely technological innovation and is increasingly reflected in the transformation of business models, improvements in productivity, and the adaptation of institutional and regulatory frameworks to modern forms of the digital economy [1,2]. In this context, AI is increasingly viewed not merely as support for existing processes, but as a strategic resource shaping new forms of entrepreneurship and long-term development trajectories.

A particularly important role in this process is played by companies that use AI as the foundation for developing complex and capital-intensive systems, most notably in the field of autonomous driving. The development of autonomous vehicles requires the integration of advanced algorithms, large volumes of data, and extensive testing in both real-world and simulated environments, making this domain one of the most technologically and financially demanding applications of artificial intelligence [3]. For this reason, autonomous driving represents an appropriate analytical framework for examining the broader impact of AI on entrepreneurship and economic development.

One of the most prominent contemporary examples of such an approach is Pony.ai, a company that has established itself as a globally relevant actor in the field of autonomous vehicles through a combination of advanced AI technologies, strong investment support, and a favorable institutional environment [4,5]. Although the success of Pony.ai is often viewed through the lens of autonomous vehicle development and deployment, the essence of its business model extends beyond manufacturing itself. The key components of this model relate to intensive data collection and processing, continuous testing and validation of AI systems, and a regulatory framework that enables experimentation, iterative development, and long-term investment.

This model raises the question of its transferability to economies that lack a developed industrial base for vehicle manufacturing but possess other relevant resources. In this regard, the Republic of Serbia represents an interesting case for analysis. Although Serbia no longer has a strong domestic automotive manufacturing industry, it does possess a growing IT sector, a technically educated workforce, experience in exporting knowledge and digital services, and relatively competitive labor costs [6,7]. These factors point to the possibility of an alternative development pathway in which Serbia could position itself not as a producer of final products, but as an AI data and testing hub—that is, a location suitable for the development, testing, and validation of AI systems for autonomous driving and related applications.

The aim of this paper is to examine the extent to which selected elements of the Pony.ai model can be conceptually adapted to the conditions of the Republic of Serbia through such an alternative development approach. The focus of the paper is not on normative policy advocacy, but on an analytical assessment of economic and institutional opportunities and constraints. Particular attention is given to identifying realistic barriers, as well as potential advantages that

Serbia could leverage in the development of AI data and testing activities, with a view toward formulating observations relevant to long-term economic strategy.

PONY.AI AS A REFERENCE CASE

Pony.ai is a technology company founded in 2016, specializing in the development of autonomous driving systems based on artificial intelligence. The company operates in the markets of China and the United States and develops solutions for high-level autonomous vehicles (Level 4), with a particular focus on robotaxi systems and the testing of autonomous technologies in real-world conditions.

The core of Pony.ai's business model consists of the development of advanced AI algorithms, large-scale data collection and processing, and continuous testing and validation of autonomous driving systems in both controlled and real environments. Unlike traditional vehicle manufacturers, Pony.ai does not represent a conventional industrial company, but rather a technology platform whose value is primarily based on data, software, and the ability to integrate within complex regulatory and institutional frameworks.

Due to this profile, Pony.ai is not examined in this paper as an example of industrial production, but rather as a reference model for understanding how AI-intensive activities—particularly those related to data collection, testing, and validation—can be organized and scaled across different contemporary economies. It is precisely these elements that make Pony.ai relevant for considering their potential adaptation to different national contexts, such as that of the Republic of Serbia.

ECONOMIC AND INSTITUTIONAL CONTEXT OF THE REPUBLIC OF SERBIA

The contemporary economic development of the Republic of Serbia has been significantly shaped by the growth of the information and communication technology (ICT) sector, which has emerged over the past decade as one of the most dynamic segments of the domestic economy. IT and digital services represent a growing source of exports, employment, and value added, with Serbia increasingly recognized as a regional center for software development and knowledge outsourcing [8,9]. This development indicates the presence of human capital and a business environment capable of supporting more complex forms of digital and AI-intensive activities.

One of Serbia's key advantages in this context relates to the structure of its workforce. The country has a relatively large number of engineers, mathematicians, and IT professionals, supported by an education system that traditionally emphasizes technical and natural sciences. At the same time, labor costs in this sector remain competitive compared to more developed European markets, making Serbia an attractive location for development and testing activities that require highly skilled personnel but not mass industrial production [8].

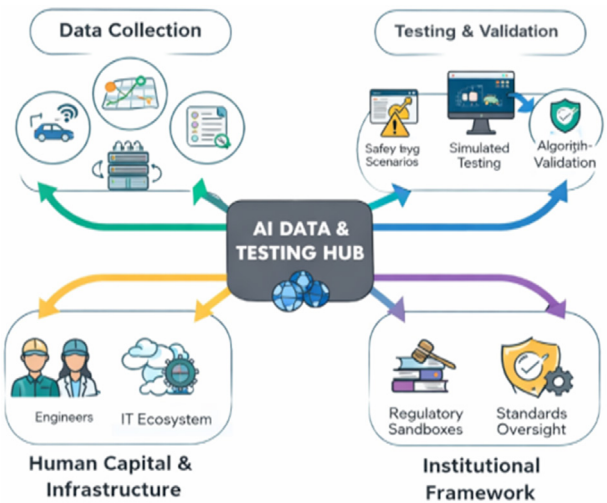
From an institutional perspective, Serbia has made certain advances in recent years in the areas of public administration digitalization, improvement of the regulatory framework for the IT sector, and support for innovation. However, the institutional framework continues to be characterized by fragmented competencies, limited coordination among

relevant actors, and a relatively slow pace of regulatory adaptation to new technological models [10]. These factors represent potential constraints on the development of activities that require intensive collaboration between the private sector, regulators, and research institutions, such as AI data and testing operations.

An important aspect of the analysis also concerns Serbia's position in the broader international context. As a candidate country for membership in the European Union, Serbia is gradually aligning its regulatory framework with EU standards in the areas of the digital economy, data protection, and artificial intelligence. Although demanding, this process may represent an advantage in terms of long-term legal predictability and compatibility with EU markets, which is particularly relevant for AI activities involving large-scale data processing and compliance with high regulatory standards [7,11].

At the same time, the absence of a strong domestic industrial base in automotive manufacturing limits the possibility of directly applying models centered on autonomous vehicle production. From the perspective of AI data and testing activities, however, this limitation does not necessarily represent a decisive obstacle. On the contrary, focusing on the development, testing, and validation of AI systems, rather than final production, may enable Serbia to integrate into global value chains through specialized, knowledge-intensive activities that require flexibility and institutional adaptability rather than capital-intensive industrial infrastructure.

Picture 1: Conceptual Framework of an AI Data and Testing Hub



Source: *Author's own elaboration with the assistance of AI tools*

In this sense, Serbia's economic and institutional context points to the existence of real, albeit limited, opportunities for the development of an AI data and testing hub. The primary potential lies in human capital, the growing IT sector, and the process of regulatory alignment with European standards, while the main constraints relate to institutional coordination, long-term investment stability, and the capacity to manage complex,

cross-sectoral projects. These elements provide the basis for further consideration of the feasibility and sustainability of such a development pathway.

This conceptual framework presents the AI data and testing hub as an integrated system in which value creation is based on continuous data collection and processing, testing and validation of AI algorithms, as well as the availability of qualified human capital and appropriate digital infrastructure. Particular importance is attributed to the institutional framework, which includes regulatory sandbox models, standards, and oversight mechanisms, as it enables experimentation and the development of AI systems while maintaining risk control.

The framework emphasizes that such a development model does not require mass industrial production, but rather enables participation in global value chains through specialized, knowledge-intensive activities. In this sense, an AI data and testing hub represents a potentially adaptable framework for economies that possess human capital and IT capacities but lack a developed manufacturing base, which makes it relevant for consideration in the context of the Republic of Serbia.

AI Data and Testing Hub as a Development Option

The AI data and testing hub can be conceptualized as an integrated ecosystem in which value creation is grounded in the continuous collection and processing of data, the testing and validation of AI systems, and the availability of skilled human capital alongside adequate digital infrastructure (OECD, 2021). This perspective underscores that the development of AI-intensive activities does not necessarily rely on industrial manufacturing capacity, but rather on knowledge assets, data availability, and institutional adaptability.

Within this model, the institutional framework plays a particularly significant role, encompassing regulatory "sandbox" mechanisms, standards, and supervisory arrangements that facilitate experimentation and innovation while ensuring risk management (European Commission, 2020). In this context, the AI data and testing hub represents a conceptually flexible development framework for economies lacking a strong manufacturing base but endowed with human capital and information technology capabilities.

Barriers to the Transfer of Elements of the Pony.ai Model to the Conditions of the Republic of Serbia

Although the concept of an AI data and testing hub represents a potentially adaptable development framework for economies without a strong industrial base, the transfer of elements of the Pony.ai company model to the context of the Republic of Serbia faces a range of structural, institutional, and market constraints. These obstacles do not necessarily indicate the infeasibility of the model, but they may significantly affect its scale, dynamics, and long-term sustainability (OECD, 2021).

One of the primary constraints relates to institutional coordination and the regulatory framework. The development and testing of AI systems, particularly in areas with security

and societal implications, require clearly defined competencies, stable procedures, and a predictable regulatory environment. In practice, flexible regulatory instruments, such as regulatory "sandbox" models, have been recognized as an important mechanism for enabling innovation while controlling risks; however, their implementation requires a high degree of institutional coordination and experience (European Commission, 2020). Limited application of such models may slow down the experimental and testing activities that are essential for AI data and testing operations.

A second significant constraint concerns limited access to large and diverse datasets. Autonomous driving models and similar AI-intensive systems rely on continuous data collection from complex real-world and simulated environments, where scenario diversity represents a key factor in testing quality (KPMG, 2022). In smaller markets, with a limited number of urban areas and testing environments, the capacity to generate such data may be constrained, thereby affecting the attractiveness of the location for certain types of testing.

The third constraint relates to the capital and investment dimension of AI-intensive models. The development, testing, and validation of AI systems involve long-term investments with delayed profitability, which require stable investment flows and a high level of risk tolerance (OECD, 2021). In the context of a relatively limited domestic venture capital market, the financing of such activities largely depends on international investors, which may influence the degree of local knowledge and value accumulation.

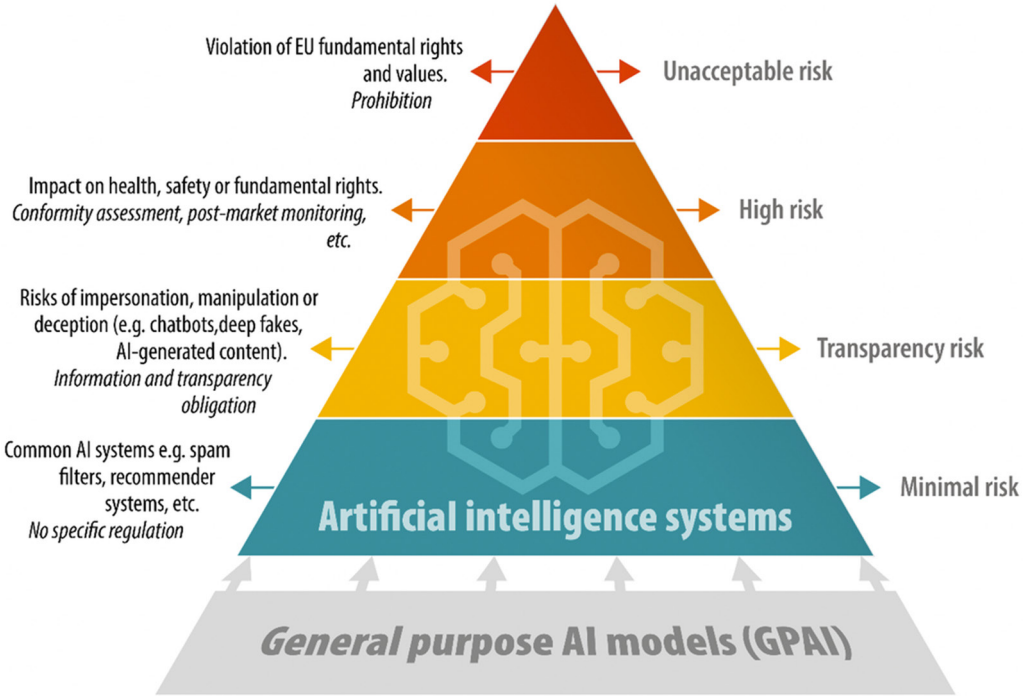
An additional limitation stems from competition in global labor markets and the mobility of highly skilled personnel. Although Serbia has a technically educated workforce, global demand for AI and IT professionals increases pressure on the domestic labor market and complicates the long-term retention of the human capital necessary for stable data and testing activities (World Bank, 2020).

Finally, a further constraint is the limited integration of domestic actors into international AI ecosystems. Models such as Pony.ai develop within robust global technological, research, and investment networks that enable rapid knowledge and resource exchange. In environments where such networks are not systematically developed, the capacity to participate in complex AI value chains may be limited (OECD, 2021).

Taken together, these constraints indicate that the transfer of elements of the Pony.ai model to Serbia is not a matter of direct replication, but rather of selective and adapted implementation. Understanding these limitations provides the basis for a realistic assessment of the scope and reach of AI data and testing activities, as well as for formulating observations on development pathways aligned with existing economic and institutional capacities.

Such a regulatory approach has direct implications for the transfer of AI-intensive models, such as the model developed by Pony.ai, into national contexts that are in the process of alignment with the European Union acquis. Given that autonomous driving systems fall into the category of high-risk AI systems, requirements related to testing, institutional coordination, and regulatory readiness represent one of the key barriers to the development of AI data and testing activities in countries such as the Republic of Serbia.

Picture 2: Classification of AI System Risks According to EU Regulation



Source: *European Commission (2020)*

Position of the Republic of Serbia in Relation to the EU Regulatory Framework

Although the Republic of Serbia is not a member of the European Union, the classification of AI systems according to risk level, presented in Figure 2, represents a relevant reference framework for the analysis of barriers to the development of AI data and testing activities. As a country in the process of alignment with the EU acquis communautaire, Serbia is gradually adjusting its regulatory framework in the areas of the digital economy, data protection, and artificial intelligence.

In this context, activities related to the testing of autonomous driving systems and related AI applications would, by their nature, fall into the category of high-risk AI systems. This classification has direct implications for requirements concerning institutional coordination, testing procedures, regulatory oversight, and overall regulatory readiness. Consequently, the position of Serbia in relation to the EU regulatory framework creates a specific environment characterized by partial alignment and ongoing regulatory adaptation, which represents both a constraint and a reference point for the development of AI data and testing activities.

CONCLUSION AND RECOMMENDATIONS

The analysis of opportunities and constraints in transferring elements of the Pony.ai company model to the conditions of the Republic of Serbia indicates that the development of AI data and testing activities does not depend on the direct replication of industrial models, but rather on the selective and adapted application of their key functional components. In particular, institutional, regulatory, and market conditions are shown to play a decisive role in determining the scale and dynamics of such a development path (OECD, 2021).

First, the results of the analysis suggest that the potential development of AI data and testing activities could be based on a **gradual and phased approach**, implemented through clearly delimited testing projects and pilot activities. Such an approach is consistent with AI system development practices, which are characterized by iterative testing and validation processes, as well as with the recommendations of international organizations regarding the governance of innovation in high-risk technological domains (OECD, 2021).

Second, the regulatory framework represents one of the key determinants of the sustainability of this model. The European approach to classifying AI systems according to risk level indicates that systems associated with autonomous driving and safety fall into the high-risk category, which entails additional requirements with respect to testing, conformity assessment, and oversight (European Commission, 2020). Although Serbia is not a member of the European Union, the process of alignment with European regulatory standards makes this framework a relevant reference context for assessing institutional constraints and requirements.

Third, the analysis indicates that the long-term sustainability of an AI data and testing hub depends on **integration into international AI value chains**, primarily through cooperation with foreign technology companies, research institutions, and investors. The experience of AI-intensive companies shows that the development of such activities requires stable investment flows and access to global knowledge networks, which is particularly important in economies with a limited domestic capital market (OECD, 2021; World Bank, 2020).

Finally, the analysis confirms that the development of AI data and testing activities is a **long-term and institutionally demanding process**, the success of which depends on continuity, regulatory predictability, and a realistic assessment of existing constraints. Rather than pursuing ambitious attempts at industrial replication, selective positioning within segments of the AI economy based on data, testing, and validation may represent a developmentally more compatible framework for economies such as Serbia, which possess human capital and IT capabilities but lack a developed manufacturing base.

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Mogućnosti primene modela Pony.ai u uslovima Republike Srbije: Potencijal razvoja AI data i testing hub-a

Apstrakt: *Rad razmatra mogućnosti primene elemenata poslovnog i razvojnog modela kompanije Pony.ai u uslovima Republike Srbije, sa posebnim fokusom na razvoj AI data i testing huba kao alternativnog razvojnog pravca. Polazeći od činjenice da Srbija više ne raspolaže razvijenom automobilskom industrijom, analiza se usmerava na one komponente modela Pony.ai koje se odnose na prikupljanje i obradu podataka, testiranje i validaciju sistema zasnovanih na veštačkoj inteligenciji, kao i na ulogu institucionalnog i regulatornog okvira u omogućavanju ovakvih aktivnosti. Rad koristi kvalitativni pristup zasnovan na analizi relevantne literature, međunarodnih izveštaja i regulatornih okvira, uz studiju slučaja kompanije Pony.ai kao referentnog primera AI-intenzivnog modela. Posebna pažnja posvećena je ekonomskim i institucionalnim karakteristikama Republike Srbije, kao i preprekama koje proizilaze iz regulatorne složenosti, ograničenog pristupa kapitalu, dostupnosti podataka i integracije u međunarodne AI ekosisteme. Zaključci rada ukazuju da prenos elemenata modela Pony.ai ne podrazumeva direktnu replikaciju industrijskog pristupa, već selektivnu i prilagođenu primenu kroz razvoj AI data i testing aktivnosti koje su kompatibilne sa postojećim ekonomskim i institucionalnim kapacitetima Srbije.*

Ključne reči: *veštačka inteligencija, Pony.ai, AI data i testing hub, institucionalni okvir, ekonomski razvoj, Republika Srbija.*

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UVOD

Razvoj veštačke inteligencije (AI) u poslednjoj deceniji postao je jedan od ključnih pokretača strukturnih promena u savremenim ekonomijama. Uticaj AI tehnologija prevazilazi domen čisto tehnoloških inovacija i sve više se ogleda u transformaciji poslovnih modela, unapređenju produktivnosti, kao i u prilagođavanju institucionalnih i regulatornih okvira savremenim oblicima digitalne ekonomije [1,2]. U tom kontekstu, AI se sve češće posmatra, ne samo kao podrška postojećim procesima, već kao strateški resurs, koji oblikuje nove oblike preduzetništva i dugoročne razvojne pravce.

Posebno značajnu ulogu u ovom procesu imaju kompanije koje AI koriste kao osnovu za razvoj složenih i kapitalno intenzivnih sistema, među kojima se ističu rešenja u oblasti autonomne vožnje. Razvoj autonomnih vozila zahteva integraciju naprednih algoritama, velikih količina podataka, kao i dugotrajna testiranja u realnim i simuliranim uslovima, što ovu oblast čini jednom od tehnološki i finansijski najzahtevnijih primena veštačke inteligencije [3]. Upravo zbog toga, autonomna vožnja predstavlja pogodan okvir za analizu šireg uticaja AI na preduzetništvo i ekonomski razvoj.

Jedan od najpoznatijih savremenih primera ovakvog pristupa je Pony.ai, kompanija koja se profilisala kao globalno relevantan akter u oblasti autonomnih vozila zahvaljujući kombinaciji naprednih AI tehnologija, snažne investicione podrške i povoljnog institucionalnog okruženja [4,5]. Iako se uspeh kompanije Pony.ai često sagledava kroz prizmu razvoja i implementacije autonomnih vozila, suština njenog poslovnog modela prevazilazi samu proizvodnju. Ključni elementi tog modela odnose se na intenzivno prikupljanje i obradu podataka, kontinuirano testiranje i validaciju AI sistema, kao i na regulatorni okvir koji omogućava eksperimentisanje, iterativni razvoj i dugoročna ulaganja.

Ovakav model otvara pitanje njegove prenosivosti u ekonomije koje ne raspolažu razvijenom industrijskom bazom za proizvodnju vozila, ali poseduju druge relevantne resurse. U tom smislu, Republika Srbija predstavlja interesantan slučaj za analizu. Iako Srbija više nema snažnu domaću automobilsku industriju, ona raspolaže rastućim IT sektorom, tehnički obrazovanom radnom snagom, iskustvom u izvozu znanja i digitalnih usluga, kao i relativno konkurentnim troškovima rada [6,7]. Ovi faktori ukazuju na mogućnost alternativnog razvojnog pravca, u kojem bi se Srbija mogla pozicionirati ne kao proizvođač krajnjih proizvoda, već kao AI data i testing hub, odnosno kao lokacija pogodna za razvoj, testiranje i validaciju AI sistema za autonomnu vožnju i srodne primene.

Cilj ovog rada je da ispita u kojoj meri se pojedini elementi modela kompanije Pony.ai mogu konceptualno prilagoditi uslovima Republike Srbije kroz takav alternativni razvojni pristup. Fokus rada nije na normativnom zagovaranju konkretnih politika, već na analitičkoj proceni ekonomskih i institucionalnih mogućnosti i ograničenja. Posebna pažnja posvećena je identifikaciji realnih prepreka, ali i potencijalnih prednosti koje bi Srbija mogla da iskoristi u razvoju AI data i testing aktivnosti, uz formulisanje opservacija relevantnih za dugoročnu ekonomsku strategiju.

PONY.AI KAO REFERENTNI PRIMER

Pony.ai je tehnološka kompanija osnovana 2016. godine, specijalizovana za razvoj sistema autonomne vožnje zasnovanih na veštačkoj inteligenciji. Kompanija posluje na tržištima Kine i Sjedinjenih Američkih Država i razvija rešenja za autonomna vozila visokog nivoa automatizacije (Level 4), sa posebnim fokusom na robotaksi sisteme i testiranje autonomnih tehnologija u realnim uslovima.

Osnovu poslovnog modela kompanije Pony.ai čine razvoj naprednih AI algoritama, masovno prikupljanje i obrada podataka, kao i kontinuirano testiranje i validacija sistema autonomne vožnje u kontrolisanim i realnim okruženjima. Za razliku od tradicionalnih proizvođača vozila, Pony.ai ne predstavlja klasičnu industrijsku kompaniju, već tehnološku platformu čija se vrednost zasniva prvenstveno na podacima, softveru i sposobnosti integracije u složene regulatorne i institucionalne okvire.

Zbog takvog profila, Pony.ai se u ovom radu ne posmatra kao primer industrijske proizvodnje, već kao referentni model za razumevanje kako se AI-intenzivne aktivnosti, posebno u oblasti prikupljanja podataka, testiranja i validacije, koje se mogu organizovati i skalirati u okviru različitih savremenih ekonomija. Upravo ovi elementi čine Pony.ai relevantnim za razmatranje mogućnosti njihove prilagodbe u drugačijim nacionalnim kontekstima, poput Republike Srbije.

EKONOMSKI I INSTITUCIONALNI KONTEKST REPUBLIKE SRBIJE

Savremeni ekonomski razvoj Republike Srbije u značajnoj meri je obeležen rastom sektora informaciono-komunikacionih tehnologija (IKT), koji se tokom poslednje decenije profilisao kao jedan od najdinamičnijih segmenata domaće ekonomije. IT i digitalne usluge predstavljaju rastući izvor izvoza, zaposlenosti i dodate vrednosti, pri čemu se Srbija sve češće prepoznaje kao regionalni centar za razvoj softvera i outsourcing znanja [8,9]. Ovakav razvoj ukazuje na postojanje ljudskog kapitala i poslovnog okruženja koje može da podrži složenije oblike digitalnih i AI-intenzivnih aktivnosti.

Jedna od ključnih prednosti Srbije u ovom kontekstu odnosi se na strukturu radne snage. Zemlja raspolaže relativno velikim brojem inženjera, matematičara i IT stručnjaka, uz obrazovni sistem koji tradicionalno naglašava tehničke i prirodne nauke. Istovremeno, troškovi rada u ovom sektoru ostaju konkurentni u poređenju sa razvijenijim evropskim tržištima, što Srbiju čini atraktivnom lokacijom za razvojne i testne aktivnosti koje zahtevaju visoko kvalifikovane kadrove, ali ne i masovnu industrijsku proizvodnju [8].

Sa institucionalnog stanovišta, Srbija je u prethodnom periodu napravila određene pomake u oblasti digitalizacije javne uprave, unapređenja regulatornog okvira za IT sektor i podsticanja inovacija. Međutim, institucionalni okvir i dalje karakterišu fragmentacija nadležnosti, ograničena koordinacija između relevantnih aktera i relativno spor proces prilagođavanja regulative novim tehnološkim modelima [10]. Ovi faktori

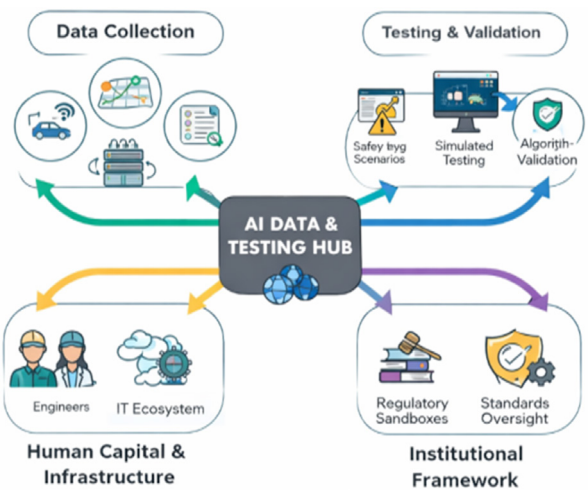
predstavljaju potencijalno ograničenje za razvoj aktivnosti koje zahtevaju intenzivnu saradnju između privatnog sektora, regulatora i istraživačkih institucija, kao što su AI data i testing operacije.

Važan element analize odnosi se i na poziciju Srbije u širem međunarodnom kontekstu. Kao zemlja kandidat za članstvo u Evropskoj uniji, Srbija se postepeno usklađuje sa evropskim regulatornim okvirima u oblasti digitalne ekonomije, zaštite podataka i veštačke inteligencije. Ovaj proces, iako zahtevan, može predstavljati prednost u smislu dugoročne pravne predvidivosti i kompatibilnosti sa tržištima EU, što je posebno relevantno za AI aktivnosti koje podrazumevaju obradu velikih količina podataka i rad u skladu sa visokim regulatornim standardima [7,11].

Istovremeno, odsustvo snažne domaće industrijske baze u oblasti automobilske proizvodnje ograničava mogućnost direktne primene modela zasnovanih na proizvodnji autonomnih vozila. Međutim, iz perspektive AI data i testing aktivnosti, ovaj nedostatak ne mora nužno predstavljati ključnu prepreku. Naprotiv, fokusiranje na razvoj, testiranje i validaciju AI sistema, umesto na finalnu proizvodnju, može omogućiti Srbiji da se uključi u globalne vrednosne lance u nišama koje zahtevaju znanje, fleksibilnost i institucionalnu prilagodljivost, a ne kapitalno intenzivnu industrijsku infrastrukturu.

U tom smislu, ekonomski i institucionalni kontekst Srbije ukazuje na postojanje realnih, ali ograničenih mogućnosti za razvoj AI data i testing huba. Potencijal leži pre svega u ljudskom kapitalu, rastućem IT sektoru i procesu regulatornog usklađivanja sa evropskim standardima, dok se glavna ograničenja odnose na institucionalnu koordinaciju, dugoročnu stabilnost investicionog okruženja i kapacitete za upravljanje kompleksnim, međusektorskim projektima. Ovi elementi predstavljaju osnovu za dalje razmatranje izvodljivosti i održivosti ovakvog razvojnog pravca.

Slika 1: Konceptualni okvir AI data i testing hub-a



Izvor: *autorska obrada uz pomoć AI alata*

Ovaj konceptualni okvir prikazuje AI data i testing hub kao integrisani sistem u kojem se stvaranje vrednosti zasniva na kontinuiranom prikupljanju i obradi podataka, testiranju i validaciji AI algoritama, kao i na dostupnosti kvalifikovanog ljudskog kapitala i odgovarajuće digitalne infrastrukture. Poseban značaj ima institucionalni okvir, koji obuhvata regulatorne „sandbox" modele, standarde i mehanizme nadzora, jer omogućava eksperimentisanje i razvoj AI sistema uz kontrolu rizika.

Prikaz naglašava da ovakav razvojni model ne zahteva masovnu industrijsku proizvodnju, već omogućava uključivanje u globalne lance vrednosti kroz specijalizovane aktivnosti visokog znanja. U tom smislu, AI data i testing hub predstavlja potencijalno prilagodljiv okvir za ekonomije koje raspolažu ljudskim kapitalom i IT kapacitetima, ali nemaju razvijenu proizvodnu bazu, što ga čini relevantnim za razmatranje u kontekstu Republike Srbije.

AI data i testing hub kao razvojna opcija

AI data i testing hub može se posmatrati kao integrisani ekosistem u kojem se stvaranje vrednosti zasniva na kontinuiranom prikupljanju i obradi podataka, testiranju i validaciji AI sistema, kao i na dostupnosti kvalifikovanog ljudskog kapitala i odgovarajuće digitalne infrastrukture (OECD, 2021). Ovakav pristup naglašava da razvoj AI-intenzivnih delatnosti ne zavisi nužno od industrijske proizvodnje, već od znanja, podataka i institucionalne prilagodljivosti.

Poseban značaj u ovom modelu ima institucionalni okvir koji obuhvata regulatorne „sandbox" modele, standarde i mehanizme nadzora, jer omogućava eksperimentisanje i inovacije uz kontrolu rizika (European Commission, 2020). U tom smislu, AI data i testing hub predstavlja konceptualno prilagodljiv razvojni okvir za ekonomije koje nemaju snažnu proizvodnu bazu, ali raspolažu ljudskim kapitalom i IT kapacitetima.

Prepreke u prenosu elemenata modela Pony.ai na uslove Republike Srbije

Iako koncept AI data i testing huba predstavlja potencijalno prilagodljiv razvojni okvir za ekonomije bez snažne industrijske baze, prenos elemenata modela kompanije Pony.ai u kontekst Republike Srbije suočava se sa nizom strukturnih, institucionalnih i tržišnih ograničenja. Ove prepreke ne ukazuju nužno na neizvodljivost modela, ali mogu značajno uticati na njegov obim, dinamiku i dugoročnu održivost (OECD, 2021).

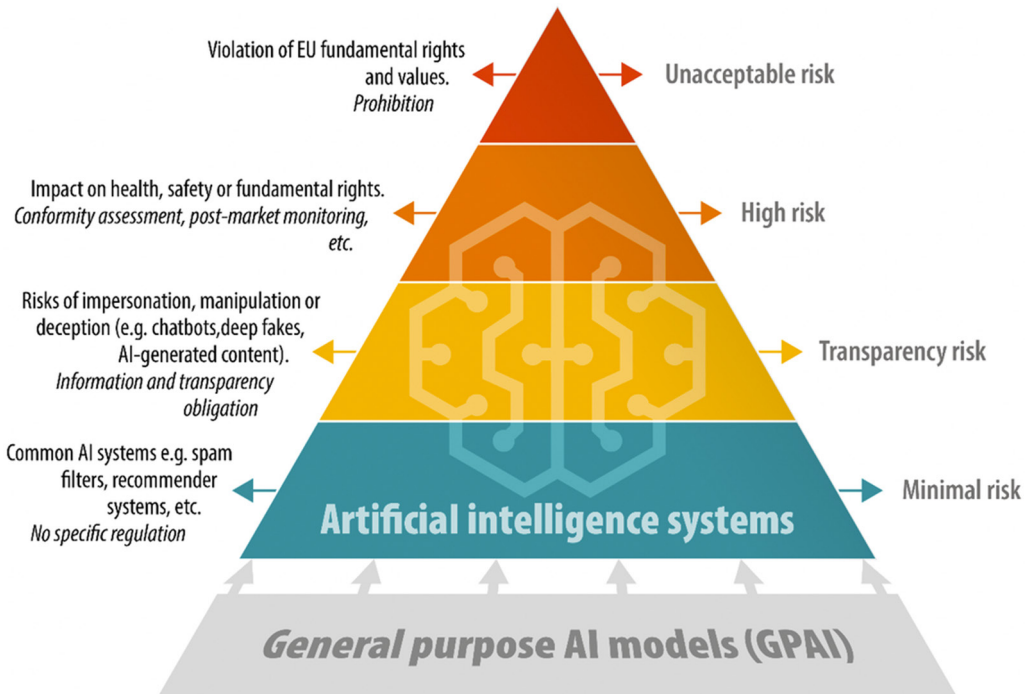
Jedna od osnovnih prepreka odnosi se na **institucionalnu koordinaciju i regulatorni okvir**. Razvoj i testiranje AI sistema, posebno u oblastima koje imaju bezbednosne i društvene implikacije, zahteva jasno definisane nadležnosti, stabilne procedure i predvidiv regulatorni ambijent. U praksi, fleksibilni regulatorni instrumenti, poput regulatornih „sandbox" modela, prepoznati su kao važan mehanizam za omogućavanje inovacija uz kontrolu rizika, ali njihova primena zahteva visok stepen institucionalne koordinacije

i iskustva (European Commission, 2020). Ograničena primena ovakvih modela može usporiti eksperimentalne i testne aktivnosti koje su ključne za AI data i testing operacije.

Druga značajna prepreka odnosi se na **ograničen pristup velikim i raznovrsnim skupovima podataka**. Modeli autonomne vožnje i slični AI-intenzivni sistemi zasnivaju se na kontinuiranom prikupljanju podataka iz kompleksnih realnih i simuliranih okruženja, pri čemu raznovrsnost scenarija predstavlja važan faktor kvaliteta testiranja (KPMG, 2022). U manjim tržištima, sa ograničenim brojem urbanih sredina i testnih okruženja, mogućnosti generisanja takvih podataka mogu biti sužene, što utiče na atraktivnost lokacije za određene tipove testiranja.

Treća prepreka odnosi se na **kapitalnu i investicionu dimenziju** AI-intenzivnih modela. Razvoj, testiranje i validacija AI sistema podrazumevaju dugoročna ulaganja uz odloženu profitabilnost, što zahteva stabilne investicione tokove i visok stepen tolerancije na rizik (OECD, 2021). U uslovima relativno ograničenog domaćeg tržišta rizičnog kapitala, finansiranje ovakvih aktivnosti u velikoj meri zavisi od međunarodnih investitora, što može uticati na stepen lokalne akumulacije znanja i vrednosti.

Slika 2: Klasifikacija rizika AI sistema prema regulativi Evropske unije



Izvor: *European Commission (2020)*

Dodatno ograničenje predstavlja **konkurencija globalnih tržišta rada i mobilnost visokoobrazovanog kadra**. Iako Srbija raspolaže tehnički obrazovanom radnom snagom,

globalna potražnja za AI i IT stručnjacima povećava pritisak na domaće tržište rada i otežava dugoročno zadržavanje kadrova neophodnih za stabilne data i testing aktivnosti (World Bank, 2020).

Na kraju, prepreku predstavlja i **ograničena integracija domaćih aktera u međunarodne AI ekosisteme**. Modeli poput Pony.ai razvijaju se u okviru snažnih globalnih tehnoloških, istraživačkih i investicionih mreža koje omogućavaju brzu razmenu znanja i resursa. U okruženjima u kojima takve mreže nisu sistemski razvijene, kapacitet za uključivanje u složene AI vrednosne lance može biti ograničen (OECD, 2021).

U zbiru, navedene prepreke ukazuju da prenos elemenata modela Pony.ai u Srbiju nije pitanje direktne replikacije, već selektivne i prilagođene primene. Razumevanje ovih ograničenja predstavlja osnovu za realističnu procenu obima i dometa AI data i testing aktivnosti, kao i za formulisanje opservacija o razvojnim pravcima koji su u skladu sa postojećim ekonomskim i institucionalnim kapacitetima.

Ovakav regulatorni pristup ima direktne implikacije na prenos AI-intenzivnih modela, poput modela kompanije Pony.ai, u nacionalne kontekste koji su u procesu usklađivanja sa pravnim tekovinama Evropske unije. Budući da sistemi autonomne vožnje spadaju u kategoriju visokorizičnih AI sistema, zahtevi u pogledu testiranja, institucionalne koordinacije i regulatorne spremnosti predstavljaju jednu od ključnih prepreka za razvoj AI data i testing aktivnosti u zemljama poput Republike Srbije.

Pozicija Republike Srbije u odnosu na EU regulatorni okvir

Iako Republika Srbija nije članica Evropske unije, klasifikacija AI sistema prema nivou rizika, prikazana na Slici 2, predstavlja relevantan referentni okvir za analizu prepreka u razvoju AI data i testing aktivnosti. Kao zemlja u procesu usklađivanja sa pravnim tekovinama EU, Srbija postepeno prilagođava regulatorni okvir u oblastima digitalne ekonomije, zaštite podataka i veštačke inteligencije.

U tom kontekstu, aktivnosti povezane sa testiranjem autonomne vožnje i srodnih AI sistema bi, po svojoj prirodi, spadale u kategoriju visokorizičnih AI sistema, što ima direktne implikacije na zahteve u pogledu institucionalne koordinacije, testiranja i regulatorne spremnosti.

ZAKLJUČAK I PREPORUKE

Analiza mogućnosti i prepreka u prenosu elemenata modela kompanije Pony.ai na uslove Republika Srbija ukazuje da razvoj AI data i testing aktivnosti ne zavisi od direktne replikacije industrijskih modela, već od selektivne i prilagođene primene njihovih ključnih funkcionalnih komponenti. Posebno se pokazuje da institucionalni, regulatorni i tržišni uslovi imaju presudnu ulogu u određivanju obima i dinamike takvog razvojnog pravca (OECD, 2021).

Prvo, rezultati analize ukazuju da bi se potencijalni razvoj AI data i testing aktivnosti mogao zasnivati na **postepenom i faznom pristupu**, kroz jasno ograničene testne projekte i pilot-aktivnosti. Ovakav pristup je u skladu sa praksama razvoja AI sistema, koje karakterišu iterativni procesi testiranja i validacije, kao i sa preporukama međunarodnih organizacija u pogledu upravljanja inovacijama u visokorizičnim tehnološkim oblastima (OECD, 2021).

Drugo, regulatorni okvir predstavlja jednu od ključnih determinanti održivosti ovakvog modela. Evropski pristup klasifikaciji AI sistema prema nivou rizika ukazuje da sistemi povezani sa autonomnom vožnjom i bezbednošću spadaju u kategoriju visokorizičnih, što podrazumeva dodatne zahteve u pogledu testiranja, procene usklađenosti i nadzora (European Commission, 2020). Iako Srbija nije članica Evropske unije, proces usklađivanja sa evropskim regulatornim standardima čini ovaj okvir relevantnim referentnim kontekstom za procenu institucionalnih prepreka i zahteva.

Treće, analiza ukazuje da dugoročna održivost AI data i testing huba zavisi od **uključivanja u međunarodne AI vrednosne lance**, pre svega kroz saradnju sa stranim tehnološkim kompanijama, istraživačkim institucijama i investitorima. Iskustvo AI-intenzivnih kompanija pokazuje da razvoj ovakvih aktivnosti zahteva stabilne investicione tokove i pristup globalnim mrežama znanja, što je posebno važno u ekonomijama sa ograničenim domaćim tržištem kapitala (OECD, 2021; World Bank, 2020).

Na kraju, analiza potvrđuje da razvoj AI data i testing aktivnosti predstavlja **dugoročan i institucionalno zahtevan proces**, čiji uspeh zavisi od kontinuiteta, regulatorne predvidivosti i realnog sagledavanja postojećih ograničenja. Umesto ambicioznih pokušaja industrijske replikacije, selektivno pozicioniranje u segmentima AI ekonomije zasnovanim na podacima, testiranju i validaciji može predstavljati razvojnije kompatibilan okvir za ekonomije poput Srbije, koje raspolažu ljudskim kapitalom i IT kapacitetima, ali nemaju razvijenu proizvodnu bazu.

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