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AI IN PUBLIC SECTOR GOVERNANCE AND ACCOUNTABILITY: A CASE STUDY OF SCARP, A WORLD BANK-FUNDED PROJECT

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ABSTRACT

Artificial Intelligence (AI) is transforming public sector governance and accountability by efficiently processing vast, complex data in real-time. AI reduces reliance on human resources and enhances efficiency, particularly in managing financial datasets by detecting anomalies like overspending and inconsistencies. While developed countries have begun benefiting from AI, many Asia-Pacific nations still face challenges in leveraging its full potential. This case study of SCARP, a World Bank-funded project, explores how AI can support public sector policymakers and development institutions in improving transparency and service delivery.

Key Words: - *Artificial Intelligence (AI), Machine Learning, Data Analytics, Public Sector Governance, Quantitative Analysis, Asia Pacific Countries, Development Institutions*

INTRODUCTION

Artificial intelligence (AI) is a concept that refers to the ability of machines to process big data and to perform a task that would have earlier required human intelligence. It is not entirely a new concept; rather it came to surface around the 1950s, and its definition has been modified over time on the basis of research and technological advancements. In 1969, Marvin L. Minsky and Seymour A. Papert published their book Perceptron, which was a systematic study of neural networks that focused the attention of the world on AI.

Big data stands for a very large and diverse collection of structured and unstructured data that piles up exponentially to a great extent over the period of time and according to IBM, 2.5 quintillion bytes of data are generated every day. These datasets are extremely large and complex in volume, velocity, and variety that traditional data management systems cannot store, process, and analyze them. It is used in machine learning, predictive modeling, and other advanced analytics to solve complex problems and make data driven decisions. Different tools like Python, Zapier, Bubble, Azure Data Factory and SSIS are used to consolidate data into a neat and analyzable state.

Artificial Intelligence and Machine Learning (using big data and algorithms to enable AI to imitate the way that humans perform complex functions) are defining technologies and have the potential to improve public sector governance and accountability through transparency, efficiency, and compliance across the world.

AI has been a popular technology area for the past decade, but generative AI (GenAI) launched an unprecedented surge of AI innovation and adoption. It has revolutionized data analytics by enabling machines to

comprehend and mimic the underlying data structure and empowered users to make data driven decisions. ChatGPT, CoPilot, Gamma, Gemini, Sora, and Microsoft Power BI are its common examples.

Data analytics in AI refers to a very sophisticated extraction of valuable information through advanced machine learning by manipulating the acquired data. Trends, patterns, schema, relations, previous learning, calculations and hidden information in the big data are identified and then presented for effective decision making, which may otherwise require a large amount of human input and working to come up with the results. Automation from data collection to decision making falls in its ambit. Important tools for data analytics are RapidMiner, Weka, KNIME, R, Stata, SAS and Python.

Broadly, data analytics are divided into three main types:

Descriptive analytics: It refers to the historical data and describes raw data that permit users to analyze data which has been classified and presented in some logical way (what has happened).

Predictive analytics: It builds a statistical model from processed raw data with the aim of being able to forecast future outcomes (what will happen).

Prescriptive analytics: It allows to forecast multiple future outcomes based on suggested course of action, showing potential effect of each decision (what should be done).

This article examines different aspects relevant to the use of AI and machine learning with a specific emphasis on governance and accountability. It also includes an extensive and systematic study of world bank funded project for clarity and better understanding.

AI in Public Sector Governance

AI has the ability to evaluate and transform working of the public sector organizations in Asia Pacific countries, if used correctly and together with suitable policy interventions. Nevertheless, the main question is how to launch the right initiatives to capitalize artificial intelligence and machine learning in public sector particularly in the development organizations. Governments can use AI for assessment of compliance and risk management, detection of fraud and corrupt practices and asset management.

The developed countries consider AI as a strategic source and use it in above mentioned areas, e.g. AI identified ownership of 500 firms by the civil servants in Brazil with contractual anomalies and in the same manner, in UK 30,000 pending cases of pension were cleared in just two weeks. These might not have been possible otherwise alone with human input. On the other hand, the speed of public sector in developing countries in AI adoption is not so appreciable rather in many of these countries it is at a very rudimentary stage.

To judge the level of adoption of this technology, the IMF has developed an AI preparedness index. The countries in the Asia Pacific region are lagging behind in this preparedness index. One of the major obstacles in adoption of artificial intelligence and machine learning in this region is lack of awareness of its potential utility in business analytics and big data processes. As a result, the civil servants of these countries are less likely to get benefits from this amazing innovation in the short to medium span.

In the following section, a case study of a World Bank funded project is included to showcase how AI can analyze and evaluate big data in less time and with greater accuracy.

A Case Study: SCARP A World Bank Funded Project

Soil salinity has been one of the biggest factors that used to hamper Pakistan's potential of producing valuable crops. Subtropical arid areas are known for extremely hot temperatures, sandy soil, low precipitation, blockage of minerals due to high salt content/ reactivity, lack of moisture content due to high evaporation rate, worst climate change and wreckage etc. All the said factors lead to salinity and water logging, which makes the soil as a whole less productive and problematic. In order to address this problem, Salinity Control and Reclamation Project (SCARP) was introduced, which later on became the world's most

extensive and costly vertical tubewell drainage program. As per world bank report, since 1960, Pakistan has installed about 12,500 tubewells over twelve complete SCARP projects, covering a culturable command area of about 6.7 million acres (or 20% of the country's irrigated land) and costing approximately Rs 6.5 billion.

This case study is the assessment of one of the major components of SCARP project which was initiated in 1997 in Bahawalpur and Cholistan areas to increase the agricultural output. Total area under consideration was around 1.5 million acres and out of which about 1.3 acres were in the domain of two canals namely, Punjnad and Abbasia Canals.

In this project, the context specific adoption of AI can significantly enhance the evaluation process with automation of data analytics, detection of anomalies and more efficient and accurate assessment of compliance and performance. It would not only improve efficiency, accuracy, and insights in multiple ways but also provide better visibility of the SCARP project to the public sector policymakers through data visualization approaches.

The following two tables show the results of vegetation in two areas: one where the SCARP was implemented and other where no such project was applied. The data was collected by using the latest GIS tagging and powerful remote sensing technologies to have quality quantitative data to analyze the vegetation in the area. The resultant statistics were as follows: -

Table 1: The land cover statistics as per supervised classification: -

Classes	1991	%	2000	%	2013	%
Urban	143.14	0.31	425.57	0.94	692.27	1.52
Barren	38004.68	83.51	30638.36	67.32	27554.54	60.55
Water	1391.61	3.06	385.26	0.85	215.35	0.47
Vegetation	5970.51	13.12	14060.75	30.90	17047.78	37.46
Total	45509.95	100	45509.95	100	45509.95	100

Table 2: The land cover statistics as per unsupervised classification: -

Classes	1991	%	2000	%	2013	%
Urban	876.9195	1.93	937.9458	2.06	1556.035	3.42
Barren	35897.57	80.72	29918.235	65.74	26755.294	58.79
Water	1352.124	2.97	241.8003	0.53	188.8785	0.42
Vegetation	7383.33	14.38	14414.72	31.67	17007.65	37.37
Total	45509.94	100	45509.94	100	45509.94	100

The data tabulated above indicates that vegetation in Bahawalpur and Cholistan has increased by 24 % from 1991 to 2013. During the same period barren land and desert have been reduced by 23 %. A very strong negative correlation i.e. -0.99 was observed between two land areas. The project has provided significant relief in the areas of the project. The case study gives an extensive insight into how the SCARP project can be analyzed, and further analytics can be executed to highlight the problems and issues.

Automated data and Financial Analysis with AI and Machine Learning

AI and machine learning can perform statistical analysis to analyze the trends and patterns of project expenditure affecting organizations adversely or having anomalies. It can also provide insight into various dimensions, like project cost deviations, efficient and optimal allocation of resources and optimal project performance.

Python is highly capable of performing quantitative analysis and is widely used from basic mathematical operations to complex statistical analytics in fields like finance, economics, auditing, and data science. Pandas and Statsmodels are important tools for data manipulation and analysis. In the earlier section, only correlation was calculated whereas Python can perform detailed statistical analysis (for example with the help of regression, we can model how the growth in

a specific area affects vegetation or water resources) through coding as described below:

```
# Convert data to DataFrame
df = pd.DataFrame(data)

# Calculate average values for each land cover category over time
df['Vegetation_Avg'] = df[['Vegetation_Supervised', 'Vegetation_Unsupervised']].mean(axis=
df['Barren_Avg'] = df[['Barren_Supervised', 'Barren_Unsupervised']].mean(axis=1)

# Calculate correlation between averaged Vegetation and Barren land areas over time
veg_barren_corr = df['Vegetation_Avg'].corr(df['Barren_Avg'])

# Display correlation result
print(f"Correlation between Vegetation and Barren land areas (1991-2013): {veg_barren_corr

# Expected Output:
# Correlation between Vegetation and Barren land areas (1991-2013): -0.99
```

Picture 1: Sample coding for statistics analysis with Python

```
# Plotting the regression line
plt.plot(df['Vegetation_Avg'], predictions, color='red', label='Regression Line')

# Adding labels and title
plt.xlabel('Average Vegetation Area')
plt.ylabel('Average Barren Land Area')
plt.title('Regression Analysis: Vegetation vs. Barren Land Areas (1991-2013)')
plt.legend()
plt.grid(True)
plt.show()
```

Picture 2: Sample coding for statistics analysis with Python.

AI has very vast applications in every field. However, a few specific areas in the context of public sector governance are discussed in the following headings/paragraphs.

Risk Management and Fraud Detection

In performing audit procedures, generative AI models, such as Generative Adversarial Networks (GANs), can learn typical data patterns and flag anomalies, aiding in fraud detection and other risk management functions.

Financial Records and Contracts Analysis: Natural Language Processing (NPL) tools powered with AI, can review procurement contracts and project documentation to ensure compliance with multilateral donors, identify risky clauses and can flag inconsistencies.

Fraud Detection in Procurement: Machine learning algorithms can detect anomalies in vendor selection and bidding processes, helping to identify non-standard practices, limited vendors, repetitive orders, duplicate bids, or irregularities that may indicate conflicts of interest or fraud.

Forecasting and Predictive Modeling

AI can improve forecasting by generating possible future scenarios based on historical data, making it useful in financial modeling, demand forecasting, and risk assessment. It can help in scenario planning and stress-testing models, providing external auditors with more robust and comprehensive models. In this SCARP project, we can build predictive model with the help of historical data to find out future land cover distributions under various scenarios.

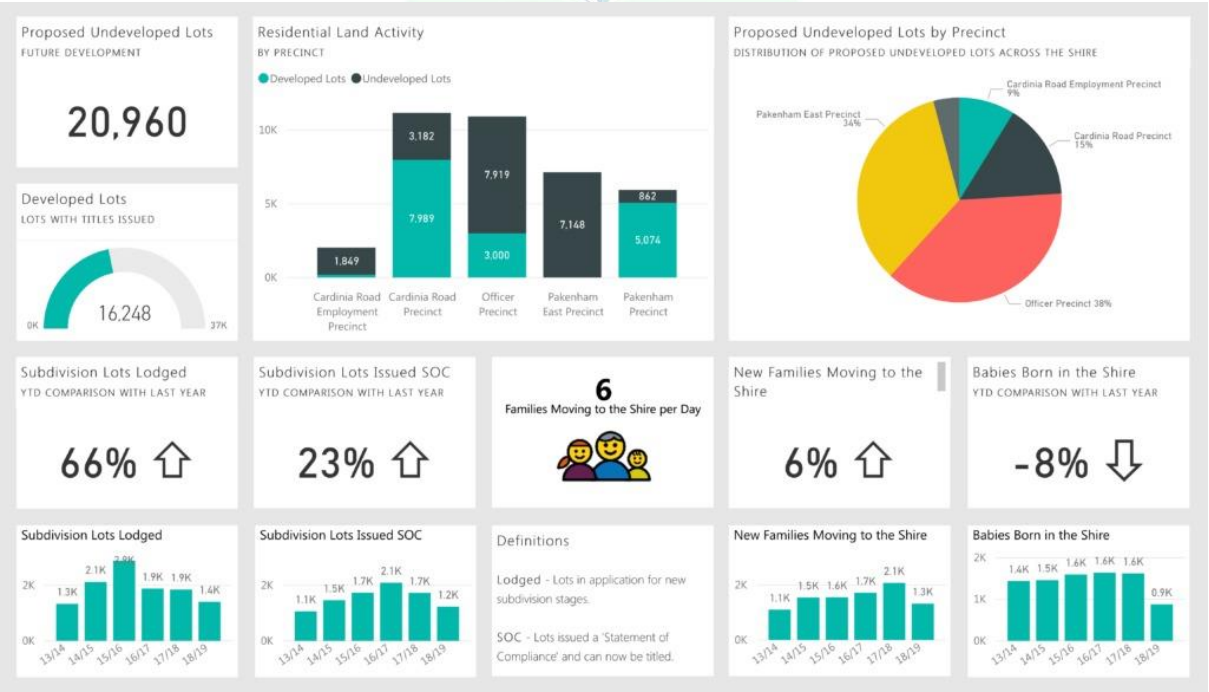
Predictive Risk Assessment: Using historical and real-time data, AI can predict possible risks like financial overruns, timeline delays, or environmental impact. This helps auditors proactively address risks before they escalate.

Enhanced Decision Support through Visualization

Power BI is a powerful tool for quantitative analysis, with capabilities for data visualization, modeling, and advanced analytics. The financial analysts can analyze and interpret data through interactive reports and dashboards.

It can generate custom visuals using R Libraries and Python like matplotlib, scikit-learn and seaborn, enabling users to create custom charts and perform statistical tests. At the same time, generative AI can create visuals and narratives based on quantitative data, helping project management authorities to understand complex data insights. The external auditors from Supreme Audit Institutions can leverage these advanced data analytics to test internal controls and apply appropriate audit procedures using machine learning models.

By generating dynamic dashboards and visual tools, it can assist auditors in exploring data interactively, leading to faster and more intuitive internal as well external audit findings. Generative AI's ability to automate data handling, modeling, and testing processes makes it a valuable tool in the audit toolkit, helping to drive insights and improve decision quality across functions. A sample data visualization created with Microsoft Power BI is add below: (Courtesy: Mr. Jahangir Sachwani, CEO, Innovinc Consulting - BI Consultant).



Picture 3: Sample data visualization with Microsoft Power BI

What Major Policy Interventions Required?

The domain and context specific training of civil servants in AI and machine learning is required to gain complete benefit of this innovative technology. Investment in AI training and certification can provide them

with basic skills in machine learning, data analytics, and AI ethics.

The data analytics, AI and machine learning is an unconstrained phenomenon, which can be harnessed to be productive, useful and assistive to decision makers. The respective information ministries can develop and promote AI based initiatives by effective training, creating awareness and chalking out policy framework for capacity building that would ultimately help to promote transparency and accountability. At the initial level, a few pilot AI projects at individual ministries/departments level could be the starting point for exploring the applications and opportunities in AI regime.

Ethical Considerations

There are ethical considerations while integrating this technology in their operations as outlined below:

Privacy and Data Protection: Individual's privacy and civil rights should be respected and protected in AI based solutions. Consent and census in this regard should be developed for manipulating the data further with the individual's right for retrieval of the information and data as well at any stage if there is a breach of contract.

Accountability: There should be an appropriate oversight agency within each information ministry for protection and monitoring of the AI design and its implementation. Any deviation from the norms should be immediately highlighted.

Safety and Security: It is the prime responsibility of policymakers in the respective countries to ensure the safety and security of the personal data through rigorous legislation and regulatory control.

Transparency: AI operates with minimal emotions, it maneuvers as per design, program and set of instructions. The public sector entities and their officials, who are impacted by AI applications, should be kept in the loop at every stage regarding activities and output via interactive communication which is essential to ensure transparency.

Conclusion

AI is bound to affect every human activity and sphere of life. Myths are being converted into realities. Driverless cars, sensitive/equipped robots, virtual reality, branchless banking are all practical realties now. Definitely it brings with it a lot of pros and cons. Every aspect and angle of the AI application and implementation should be examined carefully by the public sector policymakers and brought under regulatory and legal framework.

Machine learning can help perform routine activities, when once programmed on the basis of information and data. Public sector organizations are cluttered with scattered data and random information, which makes it difficult for the public sector policymakers to take timely and efficient decisions. Most of the countries of the Asia Pacific region are lagging behind in preparedness in terms of technology and knowledge. To capitalize the opportunities and tackle the menace, appropriate training and capacity building can be a starting point and need of the hour for these countries. As it is said "a thousand-mile journey starts with a single step".

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