

A Study on the Impact of Artificial Intelligence Techniques in Enhancing Electronic Public Procurement System

Saurabh Bansal

PhD Research Scholar

School of Computer Science and Technology

Department of Computer Science and Engineering

SAM Global University

Bhopal (Madhya Pradesh) India

Dr. Neelesh Jain

Professor and Director

School of Computer Science and Technology

SAM Global University

Bhopal (Madhya Pradesh) India

Abstract:- Governance is widely understood as the "acts or working processes of the government" and develops through the government's ability to ensure efficient, effective, transparent and responsive administration. The advent of Artificial Intelligence (AI) has brought about major advances in many areas, and one area where its potential is being realized is the electronic public procurement system. This paper examines the impact of AI on improving the government's electronic procurement system, focusing on the benefits, challenges, and implications of integrating AI technology into procurement processes. Introducing AI into electronic public procurement systems offers several benefits. AI automates repetitive tasks, freeing procurement professionals to focus on more strategic activities. AI systems can save both buyers' and suppliers' time and money by streamlining processes such as supplier selection, bid evaluation, and contract management. In addition, AI's ability to analyze large amounts of data and identify patterns enables more accurate demand forecasting, better risk management, and optimized procurement strategies.

Government procurement plays an important role in the efficient functioning of state and central governments and public institutions. The advent of AI technology has opened up new opportunities to improve public procurement processes, streamline operations, and achieve greater transparency, accountability, and cost-effectiveness. This paper reviews existing literature, analyzes case studies, and identifies AI techniques to improve e-government systems. Discuss the potential benefits, challenges, and ethical considerations associated with integrating AI into public procurement processes. Findings highlight the transformative potential of AI to revolutionize public procurement and provide policymakers, practitioners and researchers with insight into how AI technology can be effectively used in government procurement.

Keywords:- Artificial Intelligence, Electronic Public Procurement, Automation, Efficiency, Transparency, Challenges.

I. INTRODUCTION

E-procurement solutions bring tremendous value to businesses by streamlining and standardizing procurement processes. Automation makes life easier for government officials by eliminating repetitive and tedious processes. Providing features such as clear audit trails and sealed offers increases transparency and also reduces the risk of fraud and corruption. E-procurement systems not only provide real-time alerts but also help improve the decision-making process by clearly documenting and time-stamping relevant information and generating meaningful insights. A key benefit of streamlining the procurement process is fast delivery. In short, it helps reduce government spending, reduce risk, and save time. The purpose of developing an electronic system for public procurement was to reduce the risk of corruption and make the information in these transactions visible, accessible and transparent.

Artificial Intelligence comprises a wide range of applications, technologies and processes that can act "intelligently". Artificial intelligence is becoming increasingly important in electronic public procurement management as it can read procurement patterns and behaviors and connect government agencies with the best suppliers. AI-based electronic public procurement management makes supplier collaboration easier and more efficient by enabling fast approvals, automated management, one-click authentication, and secure access with digital signatures. Artificial intelligence may lack intuition and creativity compared to humans, but when it comes to performing repetitive tasks and sifting through oceans of data to find inefficiencies and opportunities, it has speed and precision that humans cannot match. With AI, state governments can streamline processes, increase efficiency, and make data-driven decisions faster.

II. BACKGROUND

AI is a set of technologies that mimic humans' ability to perceive, understand, and act, allowing machines to operate at higher levels of intelligence. This enables computer vision and audio processing to actively perceive the world around us by capturing and processing images and sounds. Natural language processing and inference engines enable AI systems

to analyze and understand collected information. AI systems can also act and perform actions in the physical world through technologies such as expert systems and inference engines. These human capacities are complemented by the ability to learn from experience and adapt continuously over time. As complexity increases, AI systems are increasingly being used to complement these functions across the enterprise.



Fig. 1. Process flow for Public e-Procurement System

Government departments may use AI-based procurement management systems to monitor supplier performance in real-time, identify risks, classify spend, and automate routine tasks such as “Request for Proposal” processing. Artificial intelligence is transforming electronic public procurement systems in this new digital age and impacting government procurement functions. Artificial intelligence is definitely on the rise. The primary purpose of AI in electronic public procurement is to support procurement teams, not replace them. Intelligence may be artificial, but the results are real. Hype aside, the integration of artificial intelligence into government electronic procurement processes will give agencies the tools they need to achieve their goals, while transforming data to make processes more efficient and financially efficient. Establish an agile governance foundation that is resilient and ready to embrace any challenger to new data-driven governance. Over the years, it has been noted that artificial intelligence has become more human than ever before. Recognize sourcing patterns and behaviors and connect with the best suppliers. This saves time on strategic activities such as vendor/ supplier selection, negotiation, and valuation, and is well worth it.

Integrating AI technology into government electronic procurement systems has the potential to streamline processes, improve decision-making, reduce costs, and improve the overall efficiency and effectiveness of procurement operations. However, when using AI in these systems, it is important to ensure proper governance, privacy, and ethical considerations to mitigate potential risks and biases.

III. ARTIFICIAL INTELLIGENCE IN PUBLIC PROCUREMENT

The integration of AI will improve the transparency and fairness of the public procurement process. By leveraging machine learning algorithms, AI systems minimize bias,

ensure objective evaluation of bids, and promote a level playing field for suppliers. This helps build trust in the procurement system among stakeholders. Integrating AI into e-government procurement systems has the potential to revolutionize procurement practices, leading to increased efficiency, accuracy and decision-making capabilities. To harness AI's benefits, government organizations must understand its capabilities, limitations, and ethical implications and implement it responsibly and effectively.

➤ *What is Artificial Intelligence in Public Procurement used for?*

IN A NUTSHELL, AI HELPS IN;

- **Enhanced Delivery Commitment:** Reduce manual intervention and processing of windows.
- **Expedited Processes:** Optimize processes, increased data processing and enhanced productivity.
- **Accelerated Scalability:** Deployment of the scalable and flexible virtual workforce at effective pricing.
- **Improved Reporting:** Immediate insight with granular visibility through dynamic Dashboards.

IV. ARTIFICIAL INTELLIGENCE IN ENHANCING PUBLIC PROCUREMENT FUNCTIONS

Artificial intelligence could significantly improve electronic public procurement systems and have some significant impacts. Here are the following ways AI can improve the efficiency and effectiveness of the electronic Public Procurement system:

- **Automation and optimization:** AI can automate many repetitive tasks in the procurement process like Data entry, document verification, invoice processing, etc. This streamlines the procurement workflow, reduces manual errors, and saves procurement personnel time.
- **Data analysis and decision support:** AI can analyze large amounts of procurement data to identify patterns, trends, and anomalies. This analysis helps procurement

professionals make informed decisions, identify potential cost savings, assess supplier performance, or forecasting demand. AI-powered decision support systems can provide real-time insights and recommendations based on historical data and market intelligence.

- **Supplier selection and evaluation:** AI algorithms can evaluate supplier performance based on various criteria such as quality, delivery, price, and compliance. AI analyzes supplier data and feedback to identify the best suppliers for specific sourcing needs, reducing the risk of selecting underperforming or non-compliant suppliers.
- **Fraud detection and risk management:** AI can detect irregularities, anomalies, or suspicious activity in procurement processes, helping prevent fraud and corruption. Machine learning algorithms can analyze historical procurement data and flag deals that deviate from established patterns. In this way, potential risks and fraud attempts can be identified early on.
- **Contract management:** AI-powered systems can support contract management by automatically monitoring contract compliance, tracking key performance indicators, and sending renewal and renegotiation notifications. This reduces administrative overhead and ensures contracts are effectively managed throughout their lifecycle.
- **Predictive analytics:** AI can use predictive analytics to forecast demand, optimize inventory, and forecast procurement needs. AI algorithms analyze historical data, market trends, and external factors to provide accurate forecasts, enabling proactive planning and cost-effective procurement.
- **Increased transparency and accountability:** AI can improve the transparency of government procurement processes by providing auditable tracking of activities and decisions. This helps ensure accountability, reduce corruption risk, and increase trust in public procurement systems.
- **Market Intelligence and Strategic Sourcing:** AI-powered tools collect and analyze data from various sources such as market trends, supplier databases, and social media to provide real-time market intelligence. It helps public procurement officials make informed decisions about procurement strategies, identify potential suppliers and negotiate favorable terms. AI can also suggest alternative procurement options based on cost, availability and quality parameters.

V. UTILIZATION OF ARTIFICIAL INTELLIGENCE TECHNIQUES IN PUBLIC PROCUREMENT

Artificial Intelligence refers to the ability of a software program to emulate human intelligence. Depending on the level of complexity, it can involve performing simple tasks, advanced decision-making, or even interacting with actual humans to accomplish specific goals.

A. Robotic Process Automation

Robotic Process Automation (RPA) involves using software robots or "bots" to automate repetitive and rule-based tasks involved in procurement processes. Bots can handle tasks like data entry, document processing, and

generating reports, thus improving efficiency and reducing human error. In public procurement, this translates to the use of tools such as robotic process automation to streamline and optimize large, repetitive and time-consuming tasks. Software robots can process invoices and approve orders, monitor Key Performance Indicators (KPIs) for internal processes, and key supplier relationship management factors such as performance and supplier compliance. Redundant events and automated alerts mean no more delays, bottlenecks, and missed opportunities to qualify for prepayment discounts or take advantage of limited-time pricing discounts on items and important materials.

AI can also help create a closed purchasing environment where contract data is leveraged to ensure that every purchase is made from the right supplier, on the best terms, at the right price, the best rates, automatically, saving them money on fraud and bill fraud.

B. Machine Learning

Machine Learning (ML) is a more advanced method of AI, wherein artificial intelligence is allowed to learn from iterative repetition, teaching itself rather than being explicitly guided by humans. Set loose on multiple, interrelated data sets, the algorithm learns to connect the dots (or data points) on its own and improve its performance over time. Machine learning algorithms can be used to analyze historical procurement data and identify patterns, trends, and correlations. This can help in predicting demand, estimating prices, and optimizing procurement processes.

C. Natural Language Processing

Natural language processing techniques (NLP) allow AI systems to understand and process unstructured data, such as documents related to procurement, emails, or user information requests. This improves communication and interaction between procurement officials and system users, improving the overall user experience.

This form of artificial intelligence has great potential for public procurement, as it enables deeper demand analysis, more strategic supply chain management, and more nuanced spending analysis. It also supports technologies, which allow humans to communicate more naturally with artificial intelligence, both by voice and text search in applications as well as through the use of advanced and automated AI tools such as **Chabot**.

Advanced AI tools, such as Chabot, can create a friendly face for government officials to chat with when ordering goods and services. But it's not just about improving the user experience. These Chabot can leverage historical spending data, contract data, and other sources of information to provide users with contextual choices that meet public procurement function standards in terms of price, condition, and control, conditions and quality, simplifying the internal ordering process while eliminating the cost of fraud and invoice fraud. Examples are increasingly seen at home or in our mobile devices, in the form of Siri, Alexa and Cortana. Chabot, a software tool that can chat online with one person, can be deployed throughout internal and external customer

service, to interact with suppliers and buyers, and to perform simple process tasks.

Chabot can be used to speed up tasks not only for the procurement team but for the entire government. Maybe someone wants to order a new keyboard, but they don't know that there is a preferred IT standard or a price limit that has been agreed upon with a certain vendor. So when they search for that item in an electronic catalog, they are overwhelmed by the choice and unaware of the restrictions and recommendations in place. The requester can interact with the

bot to personalize the purchase scenario and suggest solutions taking into account the needs identified in the conversation, the sourcing strategy (preferred supplier, item, price, and contract) and other variables such as purchase history, compliance, or direct product availability. The approver can then receive an immediate request from the bot and approval can happen instantly. The bot can then process orders, send receipts, process invoices, and make payments.

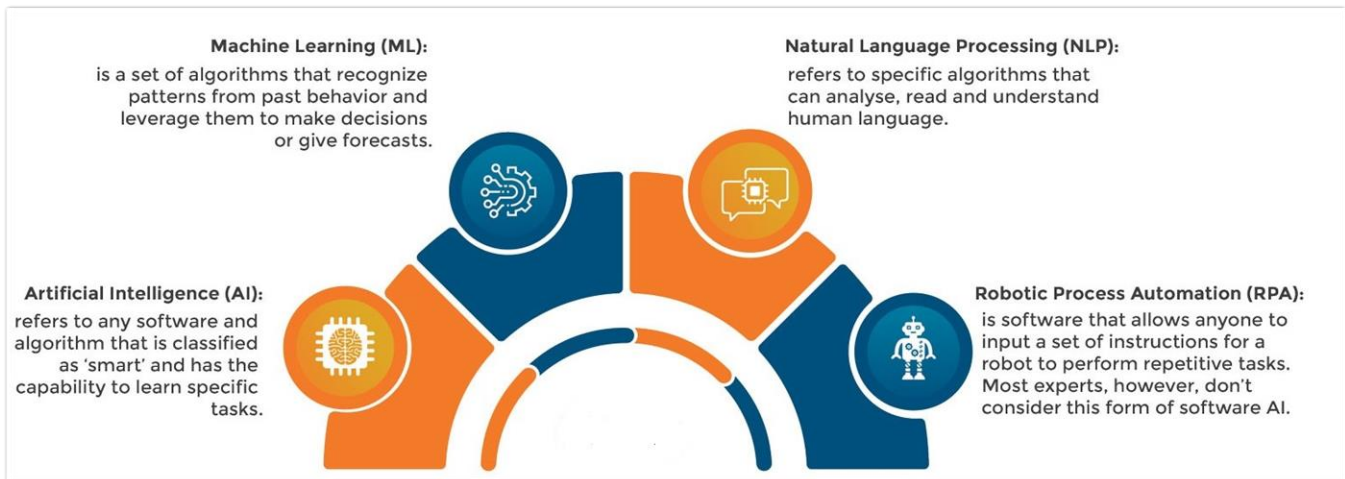


Fig. 2. Various Artificial Intelligence Techniques

D. Deep Data Analytics

Data mining is used, along with in-depth data analytics, to examine and analyze all "big data" coming and going from government departments to identify patterns, reveal insights, and improve efficiency and accuracy in strategic planning and decision-making. Clear, comprehensive, and accurate spending data serve as the foundation for all financial analysis, reporting, and planning. In addition to making data collection and management simpler, artificial intelligence also analyzes data in real time and makes it accessible from a variety of platforms and devices, wherever they may be. Complete and reliable access to all spending data, whether stakeholders are in the office or on their mobile devices somewhere in the field office, facilitating collaboration and communication.

E-procurement systems also drive more sophisticated analytics, better supplier strategy, and intelligent sourcing operations. **Advanced analytic models use large volumes of procurement data to generate cost insights and improve design through visualization technology.** Advanced contract analysis, along with contract templates and legal standards, streamlines the contract creation process. Not only are contracts created faster, but AI-powered data management tools make it easy to automatically import supplier information, terms and conditions, and pricing information. Furthermore, having access to full historical spending data, supplier performance and compliance data, and other crucial information makes contract discussions considerably more efficient. on request. Department officials can use data mining and spending analytics to understand the ever-expanding body of information at their disposal. These tools allow them to

connect very disparate data sources (suppliers, market trends, and materials data as well as all data already in existing financial and administrative processes) and "slicing" them to generate insights. Artificial intelligence may not be as intuitive and creative as humans, but they have speed and accuracy that no human can match when it comes to repetitive tasks or traversing.

E. Internet of Things

The Internet of Things (IoT) uses artificial intelligence to connect virtual and physical domains. Purchasing teams can track assets and orders through the use of special sensors that monitor location, temperature, and more and use performance data to tailor their processes and workflows.

F. Computer Vision

Computer vision techniques can be applied to analyze images and videos in procurement processes. For example, computer vision can be used to verify the quality and authenticity of products by analyzing product images or to automate the inspection of goods received against specifications.

G. Deep Learning

Deep learning, a subset of machine learning, can be utilized for more complex tasks such as image and speech recognition. In procurement, it can be used to analyze and extract information from unstructured data sources like images of product catalogs or voice recordings of supplier negotiations.

H. Predictive Analytics

Predictive analytics involves using historical data and statistical models to make predictions about future procurement outcomes. It can help in forecasting demand, predicting supplier performance, and identifying potential risks or bottlenecks in the procurement process.

I. Recommender Systems

Recommender systems can be employed to suggest relevant suppliers, products, or procurement strategies based on historical data, user preferences, and other factors. This can assist procurement professionals in making informed decisions and discovering new suppliers or products.

J. Data Mining

Data mining techniques can be used to discover hidden patterns and insights from large and complex procurement datasets. It can help identify cost-saving opportunities, optimize supplier portfolios, and improve procurement strategies.

K. Cognitive Computing

Cognitive computing combines AI techniques like NLP, machine learning, and reasoning to mimic human-like thinking and decision-making. It can be used in public procurement for complex decision support systems, where the AI system can analyze large volumes of data, consider various factors, and provide recommendations to procurement officials.

These AI techniques can be integrated into electronic public procurement systems to automate processes, improve decision-making, enhance efficiency, and promote transparency and fairness in the procurement process. Also, Blockchain technology can also enhance transparency, security, and traceability in public procurement. By using a distributed ledger, it can provide an immutable record of procurement transactions, ensuring integrity and reducing the risk of fraud or corruption.

VI. ARTIFICIAL INTELLIGENCE: KEY BENEFITS FOR PUBLIC PROCUREMENT SYSTEM

For several years now, public procurement has been undergoing a digital transformation that increasingly involves the use of deep data analytics process of Artificial intelligence. Indeed, the application of AI to public procurement offers tangible benefits, which can be divided into the following categories:

A. Information

Artificial intelligence enables the mining of large amounts of complex big data. It provides more real-time information to facilitate and improve decision-making for government procurement teams. Predictive analytics using artificial intelligence allows us to make predictions based on past data collection. However, this requires the database to be properly organized beforehand.

B. Productivity

Artificial intelligence, especially since it operates 24/7, can reduce the average public procurement process time by 25-60%. Artificial intelligence can help significantly reduce time-consuming tasks such as offer selection. Combining AI with machine learning improves productivity throughout the procurement and delivery process. Artificial intelligence will enable government procurement teams to focus on more value-added tasks.

C. Implementation

As artificial intelligence is integrated and deployed, its benefits will be shared across the government. For a successful artificial intelligence implementation, it's best to proceed step by step:

- Identify use cases for artificial intelligence in various government departments.
- Identify the most appropriate technology for data analysis and management.
- Manage change through clear and reassuring communication.

D. Savings

Artificial intelligence can lead to savings through analysis of spending and vendor panels. As a driver of real-world performance, AI targets priority areas for optimization and drives departmental decision-making. In general, artificial intelligence supports the implementation of effective strategic action plans to increase profitability.

E. Quality

Artificial intelligence ensures consistent quality by reducing manual work. Automate and improve time-consuming tasks while limiting the risk of error. From procurement to supplier relationships to transportation, artificial intelligence improves quality across the supply chain.

F. Cost

Artificial intelligence can reduce processing costs. For example, simple tasks such as level 1-2 technical support can be taken over by a Chabot.

G. Safety

AI reduces the risk of fraud and late payments by helping government departments choose the best vendor. A higher level of legal protection is guaranteed when managing procurement contracts. Therefore, artificial intelligence can help make procurement safer.

VII. KEY CHALLENGES TO THE ADOPTION OF ARTIFICIAL INTELLIGENCE

The challenge of distributing responsibility in AI systems can span three different levels. **First**, this is due to the nature of different levels of government within the country; **second**, the large number of actors involved in the design, development, and use of AI systems; This is due to the increasingly complex and opaque nature of big data. While there is great potential for advancing Artificial Intelligence in the governance space, socio-economic,

technological and regulatory realities pose unique challenges that need to be recognized and addressed when framing policy and implementing the technology. **The challenges are concentrated across common themes:**

- Lack of enabling data ecosystems
- The low intensity of AI research
- Core research in fundamental technologies
- Transforming core research into market applications
- Inadequate availability of AI expertise, manpower and skilling opportunities
- High resource cost and low awareness for adopting AI in business processes
- Unclear privacy, security, and ethical regulations
- Unattractive Intellectual Property Regime to incentivize research and Adoption of AI

These challenges, while by no means exhaustive, if addressed expeditiously through concerted collaborative efforts by relevant stakeholders, with the government playing a leading role, could lead to fundamental building blocks that form the core of India's march towards leadership in AI.

The development and maintenance of AI systems themselves also necessitate different stakeholder involvement in the process. From collecting the data to developing AI models to securing the infrastructure to maintaining the systems, multiple actors make decisions through the lifecycle of an AI system. So even setting aside the distributed responsibilities within the public entities, the AI development process is also complicated to pinpoint a certain decision that might have caused a harmful outcome. AI systems are used to analyze very large datasets to make predictions, classifications, recommendations, decisions, and more. The complexity of the datasets and some of the more advanced techniques used in AI models can make these systems very opaque and even non-functional, leaving developers and users alike unsure of what a particular result might look like. Additionally, some technologies enable AI models to continuously learn from new data and user interactions. This means that even if the original model is understood, the situation can change over time with new insights and adversarial attacks on the system.

VIII. CONCLUSION

The integration of artificial intelligence into electronic public procurement systems has the potential to revolutionize the way governments and organizations manage procurement processes. AI has many benefits, such as increased efficiency, increased accuracy, and improved decision-making skills. **One of the key benefits of AI in electronic public procurement systems is the ability to automate repetitive and time-consuming tasks.** AI-powered systems streamline processes such as vendor selection, bid evaluation, and contract management, reducing manual work and allowing procurement officials to focus on more strategic activities. This automation saves significant time and money for both buyers and suppliers. **Additionally, AI can analyze large amounts of data and detect patterns, trends, and anomalies that humans may not be aware of. Leveraging**

machine learning algorithms, AI systems can analyze historical procurement data, supplier performance metrics, market trends, and other relevant factors to uncover valuable insights and make data-driven decisions. This can lead to more accurate demand forecasting, better risk management and optimized procurement strategies.

In addition, AI can improve transparency and fairness in public procurement processes. By implementing AI algorithms, businesses can minimize bias and ensure a level playing field for all suppliers. AI systems can evaluate offers objectively by considering predefined criteria and removing human subjectivity from the evaluation process. This helps build trust in the public procurement system among suppliers and stakeholders.

However, it is important to recognize that the introduction of AI in electronic public procurement systems also comes with challenges. Privacy and security issues must be addressed to protect sensitive procurement data from unauthorized access or tampering. Ethical considerations related to AI decision-making and its potential impact on the human workplace must also be carefully evaluated and managed.

In summary, the integration of AI into the electronic public procurement system has the potential to transform procurement practices. AI offers many benefits to governments, organizations, and suppliers alike through improved efficiency, accuracy, and decision-making. **However, to ensure successful deployment and maximize associated value, it is important to fully understand AI's capabilities, limitations and ethical implications before approaching AI deployment in government procurement.**

REFERENCES

- [1]. El Asri, H., & Benhlima, L. (2022, August 15). Artificial Intelligence-Based Process Automation in eProcurement: A Systematic Literature Review. *Journal of Theoretical and Applied Information Technology*, 100(15). ISSN: 1992-8645. Retrieved from <http://www.jatit.org>
- [2]. SMART by GEP. (n.d.). Artificial intelligence and its impact on procurement and supply chain: A Comprehensive Study. Retrieved from <https://www.gep.com/white-papers/artificial-intelligence-impact-on-procurement-supply-chain>
- [3]. Lops, P., Di Ciano, M., Lopane, N., Siciliani, L., Taccardi, V., Ghizzota, E., & Semeraro, G. (n.d.). AI-based Decision Support Systems for the Management of E-procurement Procedures- Discussion Paper. Retrieved from <https://ceur-ws.org/Vol-3177/paper3.pdf>
- [4]. Cui, R., Li, M., & Zhang, S. (n.d.). AI and Procurement. Retrieved from <https://www.researchgate.net>
- [5]. Ahn, M. J., & Chen, Y.-C. (2020). Artificial intelligence in government: Potentials, challenges, and the future. In S.-J. Eom & J. Lee (Eds.), *Dg.o '20: The 21st annual international conference on digital government research*

- (pp. 243–252). Association for Computing Machinery.
<https://doi.org/10.1145/3396956.3398260>
- [6]. Campion, A., Gasco-Hernandez, M., Jankin Mikhaylov, S., & Esteve, M. (2020). Overcoming the challenges of collaboratively adopting artificial intelligence in the public sector. *Social Science Computer Review*.
<https://doi.org/10.1177/0894439320979953>
- [7]. Center for Digital Government, IBM, & NASCIO. (2019). Delivering on digital government: Achieving the promise of artificial intelligence. Retrieved from https://iapp.org/media/pdf/digital_government_artificial_intelligence.pdf
- [8]. Jain, N., Agnihotri, B. P., & Verma, A. (2013). Impact Assessment of E-Governance in India. *International Journal of Engineering and Management Research (IJEMR)*, 3(6), 128-131. Retrieved from Vandana Publication.