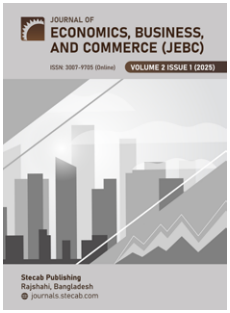

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Research Article

Adoption of RPA in Audit Practices: Comparative Insights From Bangladesh's Key Export Sectors

*[1,2,3]Md. Abu Ayub Ansari

About Article

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About Author

[1] Internal Audit & Compliance, Navana Pharmaceuticals PLC, Bangladesh

[2] Former, Textile & RMG Audit, New Asia Group, Bangladesh

[3] Former, FMCG Audit, Bengal Group of Industry, Bangladesh

Contact @ Md. Abu Ayub Ansari
abuayubansari977@gmail.com

ABSTRACT

Traditional audit procedures are being revolutionized by the development of robotic process automation (RPA), which improves accuracy, efficiency and risk management. This study investigates the strategic use of RPA in audit procedures in the Pharmaceutical and Ready Made Garment (RMG) industries, two of Bangladesh's most important and compliance sensitive sectors. This study intends to evaluate the current level of RPA integration, identify important factors that are driving and impeding its adoption and investigate its effects on audit quality and organizational readiness in light of the growing demands for transparency, regulatory compliance and digital transformation. Through surveys and semi structured interviews, the research gathers insights of audit experts, industry stakeholders, and technology experts using an integrated case study methodology. Findings reveal notable differences in RPA stage of maturity between firms, with obstacles stemming from a lack of technical know-how, gaps in infrastructure and unclear regulations. However, businesses that have adopted RPA report major improvements in control trust, data processing and audit speed. In addition to adding to the small amount of research on audit automation in developing nations, this study offers a tactical framework for the effective implementation of RPA in Bangladesh. In order to ensure increased accountability, efficiency and competitive advantage, it provides actionable advice for legislators, auditors and business executives to work together to advance digital transformation in audit services.

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1. INTRODUCTION

Organizations increasingly utilize automation tools to improve the accuracy and efficiency of business processes in the rapidly changing digital landscape of today. One such invention that is altering the way routine and rule based operations are carried out in a variety of businesses is robotic process automation or RPA. RPA permits faster, error free operations and frees up human resources for more strategic work by using software robots to mimic human activities in digital systems.

Two important export driven industries in Bangladesh, a rapidly expanding South Asian nation are Pharmaceuticals and Ready Made Garments (RMG). In addition to being vital to the nation's GDP, these industries are highly regulated, necessitating strong audit and compliance systems. In these industries, traditional audit procedures frequently encounter difficulties like inconsistent data, human error and a lack of real time insights and inefficient use of resources. RPA can be strategically implemented to improve audit accuracy, save time and money and free up auditors to work on value added duties in such a setting. Although RPA has been widely adopted in international sectors like banking, insurance and logistics, its use in audit procedures in underdeveloped nations is still quite limited. The RMG and PHARMA industries, two of Bangladesh's most important and rapidly expanding sectors, handle substantial amounts of transactional data.

This study investigates the application of robotic process automation (RPA) in auditing Bangladesh's pharmaceutical and ready-made garment (RMG) industries, two important export driven sectors. These industries deal with audit issues such inconsistent data, human error and a lack of real time insights. RPA can automate processes like financial reconciliation, data extraction and control testing, increasing the accuracy and efficiency of audits. RPA is still rarely used in audits in developing nations, despite its widespread adoption. In order to provide policymakers and audit professionals with insights into modernizing audit procedures in Bangladesh, this study looks at implementation scenarios, advantages and obstacles, such as skill gaps, opposition to change and regulatory concerns.

1.1. Research objectives

i. To assess the current level of awareness and adoption of RPA technologies in audit practices within the Ready Made Garments (RMG) and Pharmaceuticals sectors in Bangladesh.

ii. To identify the key drivers and motivations behind the adoption of RPA in the audit processes of organizations operating in these two sectors.

iii. To examine the specific areas of audit processes (transaction testing, data reconciliation, compliance checks) where RPA is being implemented or holds potential for implementation.

iv. To analyze the challenges and barriers faced by audit firms and internal audit departments in adopting and integrating RPA technologies.

v. To analyze the level of preparedness and technical capability of audit firms and internal audit teams in these sectors for RPA implementation.

vi. To compare RPA implementation practices between the RMG and Pharmaceuticals sectors to identify sector specific trends and differences.

vii. To evaluate the impact of RPA adoption on audit efficiency, accuracy, compliance and risk mitigation within the RMG and Pharmaceuticals sectors.

viii. To explore the role of auditors technical expertise, organizational readiness and regulatory frameworks in facilitating or hindering the adoption of RPA tools.

ix. To investigate the role of auditors in an RPA enabled environment & analyze how RPA adoption changes the roles, responsibilities and required competencies of internal and external auditors.

x. To provide practical recommendations and a strategic framework for enhancing RPA adoption in audit practices within the Bangladeshi context, especially in the targeted sectors.

1.2. Research questions

i. What is the current extent of RPA usage in audit processes in the RMG and Pharmaceuticals sectors in Bangladesh?

ii. What are the key factors driving RPA adoption in audits within these industries?

iii. What technical, organizational and regulatory challenges hinder the implementation of RPA in audit functions?

iv. How does RPA impact the efficiency, accuracy and quality of audits in the RMG and Pharmaceuticals sectors?

v. What are the similarities and differences in RPA adoption trends between the RMG and Pharmaceuticals sectors?

vi. How prepared are audit professionals and firms in Bangladesh to adapt to RPA enabled audit environments?

vii. How is the role of auditors evolving with the integration of RPA in the audit process?

viii. What strategic framework or model can be proposed for the effective adoption and implementation of RPA in audit functions in these industries?

ix. How can industry stakeholders (regulators, audit firms, tech providers) support and facilitate RPA adoption in audit processes?

x. What strategies can be recommended to facilitate and accelerate the effective integration of RPA in auditing within these sectors?

2. LITERATURE REVIEW

Software robots are used in robotic process automation (RPA), a type of business process automation to carry out repetitive, rule-based activities quickly and precisely. Processes including data extraction, invoice matching, reconciliation, compliance checks and audit trail documentation are being automated in the auditing environment more and more through the use of RPA. RPA improves audit productivity, lowers human error and frees up auditors to work on more strategic and analytical responsibilities, claim PwC (2019) and Deloitte (2020).

2.1. An international view of RPA

In Audit Research from industrialized nations indicates a notable trend toward digital auditing. The increasing application of RPA and other cutting-edge technologies like artificial intelligence (AI) and data analytics in contemporary auditing practices is highlighted by Issa et al. (2016) and Rozario and Vasarhelyi

(2018). These technologies provide continuous auditing, better assurance quality and better risk assessment. In order to address the increasing complexity of business environments, audit companies worldwide are already integrating RPA into their audit methods, despite initially reluctance.

2.2. Deployment of RPA in developing nations

Because of infrastructural constraints, a lack of experience, and cultural reluctance to automation, RPA adoption in audits is comparatively sluggish in developing nations. Although knowledge of digital technologies is growing in developing markets, Yoon et al. (2020) contend that low firm digital maturity and resource limitations are impeding practical deployment. Nonetheless, other sectors are more receptive to RPA deployment when operating volume and regulatory constraints dictate compliance and efficiency. As banking, manufacturing, and healthcare.

2.3. The bangladeshi setting: the digitalization of the pharmaceutical and RMG industries

The pharmaceutical and RMG industries in Bangladesh play a significant role in the GDP and export revenue of the nation. Though adoption in the accounting and auditing procedures remains restricted, both sectors have gradually seen their businesses become more digital. Some larger RMG organizations have started experimenting with digital technologies for payroll and inventory audits (Rahman & Haque, 2022). In a similar vein, pharmaceutical businesses are automating internal controls and compliance reporting due to their strict compliance obligations. There is, however, a dearth of studies explicitly looking into RPA's application in audit procedures in these sectors.

2.4. Obstacles to the use of RPA in audit

High upfront expenditures, a shortage of qualified IT staff, low awareness, and worries about job displacement are the main obstacles to RPA implementation in auditing. Uncertain legislative frameworks and cultural opposition are also significant obstacles, according to Sutton et al. (2019). These problems are made worse in Bangladesh by traditional auditing businesses' general lack of IT integration, as Chowdhury and Islam (2021) discuss.

2.5. RPA in audit: prospects and the future

RPA has a lot of potential in auditing, despite the difficulties. RPA can change audit functions from static, retrospective reviews to dynamic, continuous assurance mechanisms as businesses look for cost effectiveness, compliance assurance, and real-time insights. Additionally, RPA provides scalability and standardization advantages, which are especially helpful for high volume sectors like pharmaceuticals and RMG. Research indicates that the implementation of RPA can greatly improve the caliber and reach of audits with the correct policy backing, training, and strategic planning.

2.6. Effect on the auditor's role and audit practice

By moving the emphasis from transactional testing to strategic risk analysis and consulting services, RPA is changing the job of auditors. It is now necessary for auditors to be proficient in both technology and accounting. The idea of the "augmented auditor," as defined by Yoon et al. (2020), supports this shift by arguing that automated tools complement human expertise rather than replace it.

2.7. Strategic relevance and research gaps

Although research on RPA in the audit sector is expanding globally, there aren't many studies specifically conducted in Bangladesh. There is currently no thorough study that looks at how RPA is being strategically implemented in the audit procedures of the pharmaceutical and RMG industries, which are both vital to the domestic economy and foreign investment. By examining the current level of RPA adoption, identifying contextual constraints, and putting forth a strategic framework specifically suited to the Bangladeshi setting, this study aims to close that gap.

3. METHODOLOGY

3.1. Design of research

This study examined the usage of RPA in audit methods in Bangladesh's pharmaceutical and RMG industries using a qualitative, case based methodology. Purposively chosen firms were chosen on the basis of their active audit functions, market relevance and present or anticipated RPA use. Both domestic and foreign businesses at different stages of RPA adoption were represented in the sample. Internal documents and industry reports were used as support for the semi structured interviews with audit and IT specialists that were used to collect the data. Although the findings are reflective of the sector, non-random sampling limits their generalizability. Confidentiality was guaranteed to promote candid feedback and results were cross validated using documents and third party data to lessen self-reporting bias.

3.2. Data collection and sampling

Companies from the RMG and pharmaceutical industries that have either integrated RPA into their audit procedures or are in the process of doing so were chosen using a purposive sample technique.

i. Three pharmaceutical firms and four RMG companies were the main subjects of the investigation.

ii. Senior management (internal auditors, audit managers, and compliance officers)

IT staff and audit specialists from these companies.

The following techniques were used to gather the data:

i. 15 - 20 important stakeholders participated in semi structured interviews.

ii. Hold focus groups with internal audit teams (FGDs).

iii. Document analysis, such as RPA tool usage guides, automation process documentation, and internal audit reports.

3.3. Analysis of data

Thematic analysis was used to find recurrent themes, patterns, and trends in the data pertaining to:

i. The factors and drivers behind the adoption of RPA.

ii. A process for implementation.

iii. The difficulties and constraints faced.

iv. Impact on risk management, accuracy, and audit efficiency.

3.4. Reliability and validity

Triangulation was utilized to compare information from FGDs, interviews and documents in order to assure validity. By providing chosen participants with summaries of the findings for their input, member checking was also carried out. Keeping a research audit trail, which documented every stage from data collection to final analysis, improved reliability.

3.5. Moral points to remember

All participants gave their informed consent. To ensure confidentiality, the identities of people and businesses have been encrypted. The researcher's affiliated university's institutional review board (IRB) granted ethical approval.

4. RESULTS AND DISCUSSION

Robotic Process Automation (RPA) is a technology that automates repetitive, rule-based processes that are often completed by humans using software robots, or "bots." These bots are capable of simulating human tasks like data entry, transaction processing, application login, and report generation across a variety of digital platforms. RPA is software based and usually used for back-office tasks; it does not use actual robots. Software solutions that facilitate the creation, deployment, and management of software bots that mimic human behavior while dealing with digital systems and software are referred to as robotic process automation or RPA.

4.1. How it operates

RPA bots communicate with databases, websites, apps, and user interfaces to carry out operations like,

i. Data entry
ii. Automation of payroll and invoice processing
iii. Reporting compliance and managing inventory

4.2. Importance of RPA adoption in bangladesh's RMG & pharma industry

Robotic Process Automation (RPA) has a lot of promise to boost operational efficiency and digital transformation in an array of industries in Bangladesh. RPA provides an efficient way to automate repetitive and rule-based operations as the nation moves further with the "Digital Bangladesh" plan, lowering reliance on manual labor and minimizing human error. RPA can increase accuracy, guarantee regulatory compliance, and speed up service delivery in industries like banking, finance, auditing, healthcare, and public administration. RPA offers businesses, particularly those with limited resources, the chance to boost productivity while lowering operating expenses. Likewise, using RPA enables Bangladeshi firms to maintain a competitive edge, enhance customer service, and react quickly to market developments as global combat heats up. Automation in the public sector can assist fight problems like corruption and process delays by increasing transparency and efficiency in citizen services. All things considered, RPA adoption is not only a major driver of economic expansion but also a crucial component of Bangladesh's modern, technologically advanced workforce.

4.2.1. Ready made garments (RMG) industry

With millions of staff, the RMG industry is Bangladesh's biggest source of export revenue. RPA may nonetheless greatly enhance supporting operations, despite the labor-intensive nature of RMG manufacturing makes total automation impractical:

A. Making back office operations more efficient:

i. Automate the management of HR records, payroll processing, and attendance.
ii. Cut down on manual labor in vendor management, order recording, and procurement.

B. Improving reporting & compliance:

i. Automate compliance reports (papers for audits, labor law reporting).
ii. Assure timely and accurate export documentation submission.

C. Boosting Supply Chain Coordination:

i. Automate shipment tracking and inventory changes.
ii. Facilitate shorter responses to supplier requests and customer orders.

D. Quality control support:

Integrate data from quality inspection systems and automatically create defect reports or compliance checks.

4.2.2. Pharmaceutical industry

Bangladesh's drug industry is an ideal fit for RPA implementation due to its rapid growth and rigid rules.

A. Regulatory compliance:

i. Create compliance paperwork for regulatory agencies (DGDA, WHO) regularly.
ii. Better track and audit clinical data.

B. Data management in R&D:

i. Faster the processing of data from medication development or clinical trials.
ii. Spend less time on monotonous documentation duties.

C. Supply chain & inventory automation:

i. Automate notifications for reorders, expiration tracking, and stock level monitoring.
ii. Simplify logistics processes to guarantee swift delivery.

D. Customer relationship management (CRM):

i. Automate the processing of customer calls and updates to product orders.
ii. Optimize post-purchase assistance by including Chat bots.

4.3. RPA's advantages in the RMG and pharma sectors

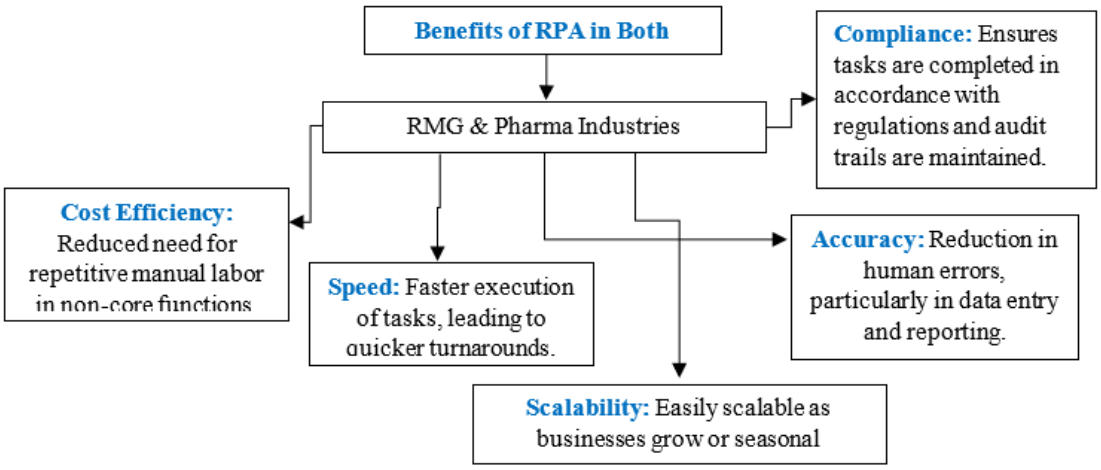


Figure 1. Benefits of adoption RPA in RMG & Pharma Industry in bangladesh

Figure 2. Diagram of how RPA adoption matters in bangladesh

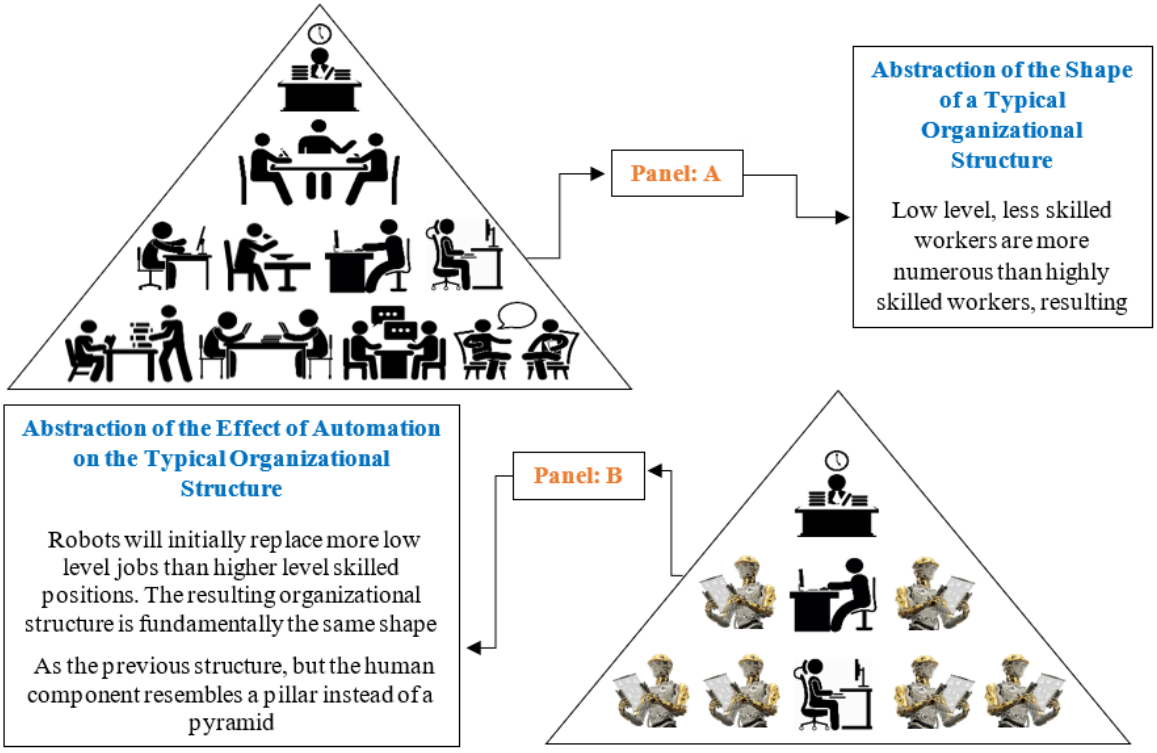


Figure 3. Insertion of Robotic Devices into Human Processes

Figure 3, illustrates the effect of replacing electronics with human based operations in a symbolic manner. Both the consequences of personnel replacement and the reframing of technology processes need to be taken into account when considering these replacements. "The reconsideration of methods and processes on an area of endeavor consequent of the advent of a disruptive technology" is how the authors define technological process reframing (TPR). But in the present situation, some of the technologies have been around for a while and their application to automate manual operations that have been done artisanal has a significant impact.

Work replacement has been a significant concern in recent years and has a substantial body of study across several industries. The auditing profession has generally been concerned with the skills required for future auditors as well as the impact on the current workforce. The advantages of RPA in Bangladesh's pharmaceutical and RMG industries are displayed in this comparison bar chart. With ratings out of 10, each bar shows the degree to which RPA adds to a certain benefit.

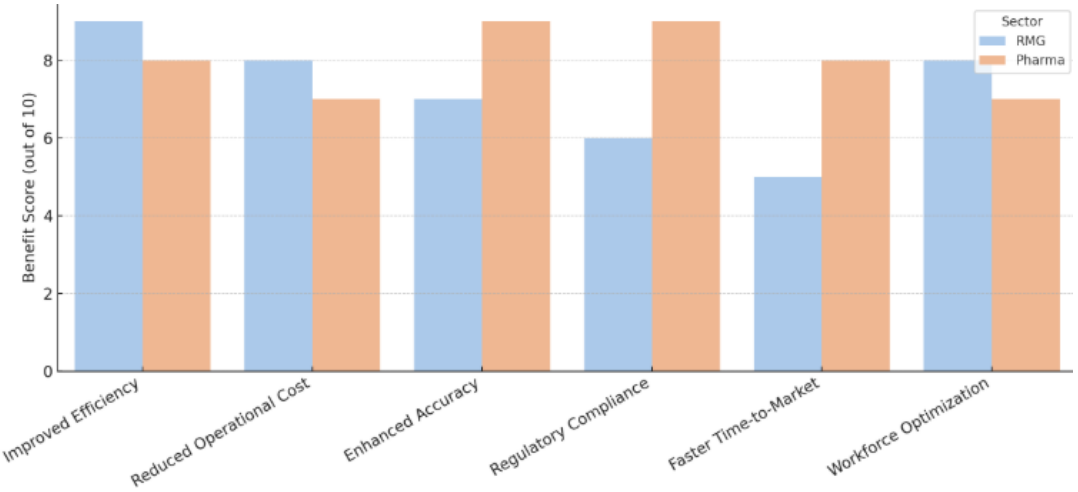
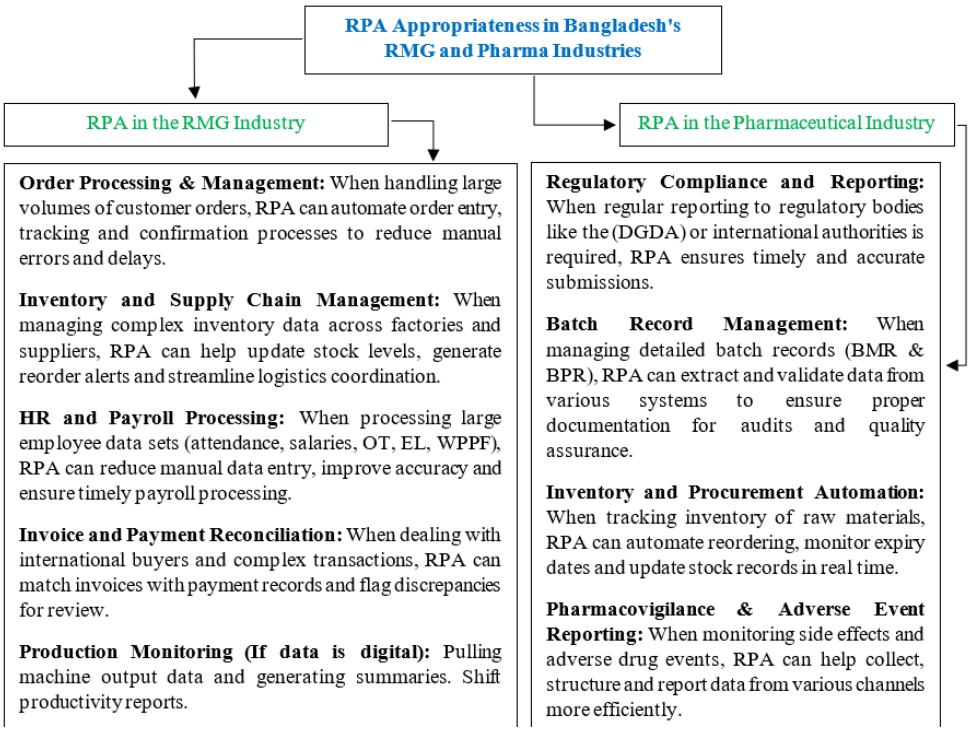


Figure 4. Statistical Chart, benefits of RPA in RMG & Pharma sector in Bangladesh & these data are showing, answering by 35 auditors in Google form, from RMG & Pharma background.

The pharmaceutical and RMG sectors are two of Bangladesh's most important and rapidly expanding industries. Greater precision, efficiency and compliance are becoming more and more necessary as these businesses grow. Organizations can streamline operations and maintain their competitiveness in both domestic and international markets by automating routine, rule based business activities with robotic process automation (RPA).



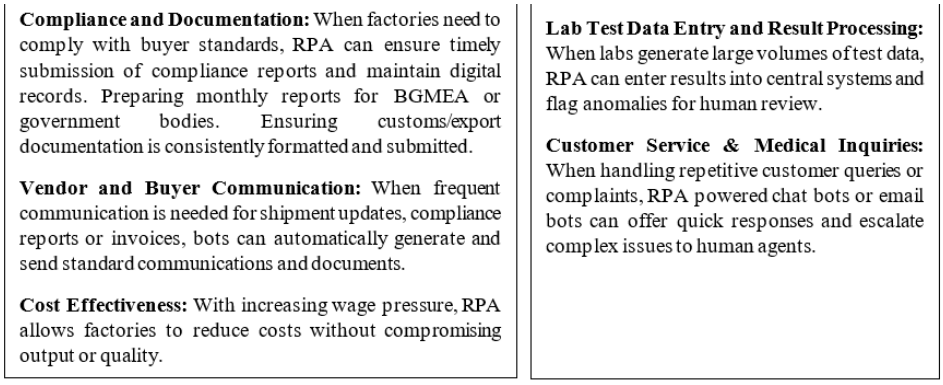


Figure 5. Diagram of RPA Appropriateness in Bangladesh's RMG and Pharma Industries

4.4. How is RPA actually used in the audit service in bangladesh's RMG & pharmaceutical industry?

Here is a detailed breakdown of how Robotic Process Automation (RPA) functions in the audit function within Bangladesh's Ready Made Garments (RMG) and pharmaceutical industries. RPA does repetitive, rule based operations across multiple systems by imitating human behaviors.

STEP 1: Identify Repetitive Audit Tasks

The first step is to identify routine, rule based and time consuming tasks in the audit process that are suitable for automation. Examples in RMG and Pharma sectors include:

a. Data extraction from ERP systems or Excel sheets
b. Invoice matching
c. Inventory reconciliation
d. Compliance checklist verification
e. Vendor payment tracking
f. Batch production record checking, especially in pharma

STEP 2: Design the RPA Workflow

After identifying tasks, audit teams collaborate with RPA developers to design a workflow (a set of rules and actions) that the software bots will follow.

Example for Pharma:

a. Pull batch records from digital logs
b. Cross check against GMP (Good Manufacturing Practice) requirements
c. Flag discrepancies for manual review

STEP 3: Deploy RPA Bots

The RPA bots are then developed using tools like UiPath, Automation Anywhere or Blue Prism. These bots are programmed to log in to systems, copy data, compare records and generate audit logs, just like a human would.

Example for RMG:

a. Bot logs into Tally, ERP or Oracle
b. Extracts purchase order & supplier invoice data
c. Compares them to delivery receipts
d. Flags mismatches

STEP 4: Run Automated Audit Tasks

a. Compliance checks: Ensuring factories comply with labor laws, environmental standards, etc.
b. Payroll audits: Cross checking attendance data with payment sheets
c. Inventory audits: Verifying system records against actual warehouse logs
d. Transaction audits: Verifying high risk transactions or journal entries.

STEP 5: Generate Reports & Exceptions

Once the bot finishes its process:

a. It generates audit logs or exception reports
b. Flags issues (duplicate invoices, missing compliance documents)
c. Sends alerts or summary reports to auditors via email or dashboards

STEP 6: Human Review & Risk Analysis

Auditors review flagged exceptions, analyze root causes and decide on actions. RPA doesn't replace auditors, it augments their work by:

a. Reducing time spent on manual data checks
b. Increasing the scope of audit coverage
c. Allowing focus on risk based auditing

STEP 7: Continuous Improvement & Scaling

Audit teams evaluate the bot's performance & improve rules and logic over time. As confidence grows, more processes are added to RPA.

a. In RMG: Compliance with buyer codes, wage audits
b. In Pharma: Traceability in supply chain audits, regulatory filing checks.

4.5. Challenges of RPA adoption in bangladesh's RMG & pharma industry

The challenges of RPA adoption in Bangladesh's RMG and pharmaceutical industries are significant, especially considering the unique operational, economic and regulatory environment. Here's a detailed breakdown:

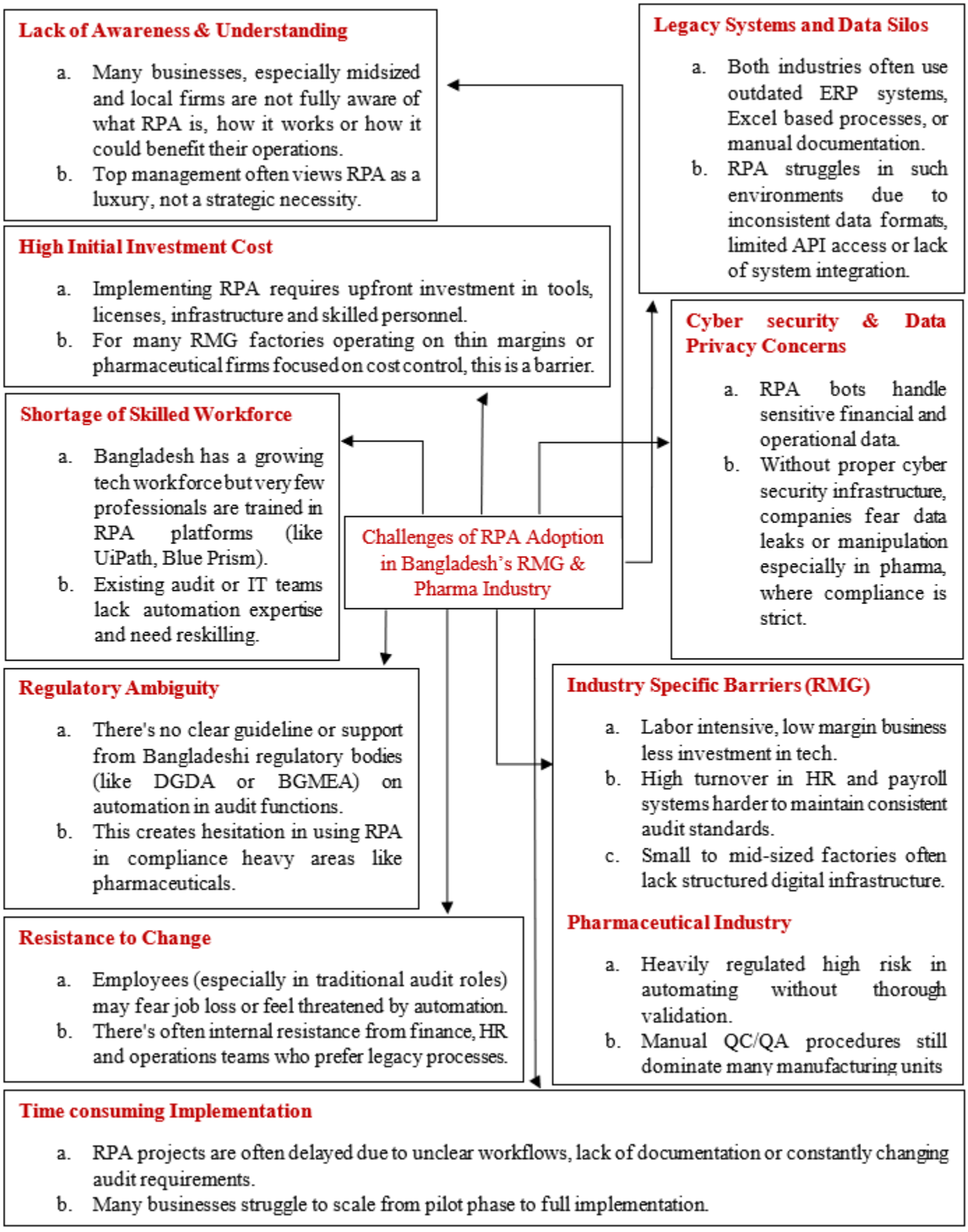


Figure 6. Challenges of RPA adoption in bangladesh's RMG & pharma industry

4.6. RPA implementation approache in bangladesh

Here's a step by step approach to implementing Robotic Process Automation (RPA) in Bangladesh, tailored to the context of local industries like finance, audit, telecom and manufacturing, while considering infrastructure, regulations and workforce readiness.

4.6.1. RPA Implementation Approaches in Bangladesh

Top down Approach

a. Driven by leadership: Senior management initiates RPA programs as part of digital transformation.

b. Popular in large enterprises: Especially in banking, telecom, RMG & Pharma sectors.

c. Examples: Banks like BRAC Bank and Eastern Bank Ltd have adopted RPA to automate KYC, loan processing and customer onboarding.

Bottom up Approach

a. Department led automation: Individual departments identify repetitive tasks and propose RPA solutions & Seen in mid-sized firms or internal audit departments.

b. Challenge: Often lacks enterprise wide integration and governance.

Center of Excellence (CoE) Model

a. Centralized RPA team: A dedicated RPA team or unit governs development, training and maintenance.

b. Used by MNCs and large local conglomerates like Robi Axiata or Grameenphone.

c. Benefits: Ensures scalability, governance, and knowledge sharing.

Pilot First Strategy

a. Start small, scale gradually: Organizations run pilot projects in low risk areas (invoice processing).

b. Grows organically based on ROI and success rate & Common in SME's and government agencies.

Hybrid Model

a. Combination of top down governance with bottom up innovation.

b. Encourages cross department collaboration and innovation while aligning with strategic goals.

c. Example: Some consultancy firms and outsourcing companies in Dhaka.

4.7. An overview of the advancement made in bangladesh's pharmaceutical and Ready Made Garment (RMG) industries over the past 15 years (2010-2025)

The readymade garment (RMG) and pharmaceutical (Pharma) industries in Bangladesh have grown and changed significantly during the last 15 years, making major contributions to the economic progress of the nation.

4.7.1. Industry for Ready Made Garments (RMG)

a. Globalization and Growth: Bangladesh is now the world's second largest exporter of clothing, behind China, thanks to the RMG industry. Exports have increased dramatically, with the US and EU being the primary markets.

b. Workforce and Infrastructure: The industry employs more than 4.5 million people, the majority of whom are women and has experienced advancements in workplace safety and factory infrastructure, particularly since the Rana Plaza tragedy in 2013, which prompted international programs like Accord and Alliance.

c. Sustainability move Bangladesh is currently home to some of the world's leading eco-friendly clothing factories, reflecting a slow move towards green and sustainable production.

d. Value Addition and Diversification: The focus is expanding beyond basic garments to high value products like suits and outerwear, and investment in automation and skill development is increasing.

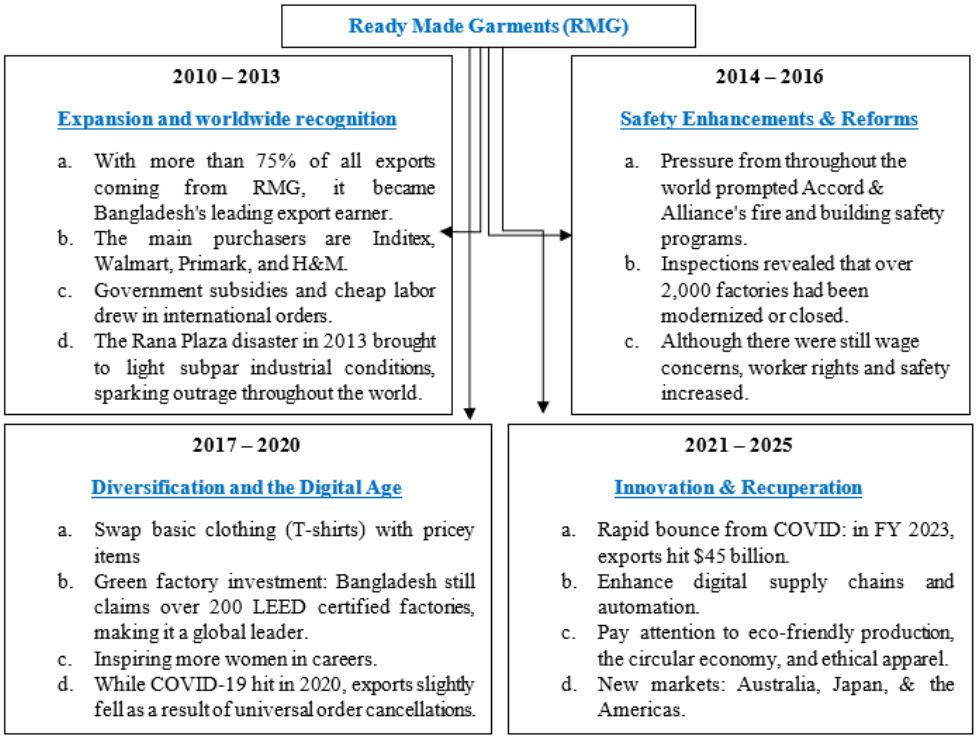


Table 1. Comparative Statement on Export of RMG & Total Export of Bangladesh

Year	Export of RMG	Total Export of Bangladesh	% of RMG's to total export
2012-2013	21515.73	27027.36	79.61
2013-2014	24491.88	30186.62	81.13
2014-2015	25491.4	31208.94	81.68
2015-2016	28094.16	34257.18	82.01
2016-2017	28149.84	34655.9	81.23
2017-2018	30614.76	36668.17	83.49
2018-2019	34133.27	40535.04	84.21
2019-2020	27949.19	33674.09	83
2020-2021	31456.73	38758.31	81.16
2021-2022	42613.15	52082.66	81.82
2022-2023	38142.1	46430.71	82.15
2023-2024	36151.31	44469.74	81.29

Source: BGMEA

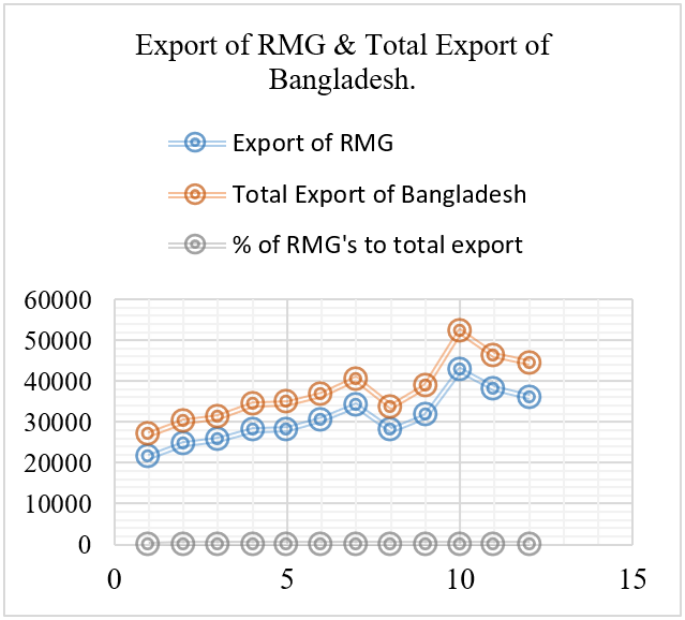


Figure 7. Export of RMG & Total Export of Bangladesh.

4.8. Connecting Bangladesh's GDP, HR, Market Growth and RMG's contribution during the past few years

Bangladesh's ready-made garment (RMG) industry has grown to be the mainstay of its export based economy and a major contributor to GDP growth over the last ten and a half years. This industry has continuously been essential in changing the economic environment, creating jobs, and improving the nation's standing in international trade.

Table 2. Diagram of RMG's Contribution to GDP over the last 10 Years of Bangladesh

Fiscal Year	RMG Export (USD Billion)	RMG as % of GDP
2013–14	24.49	14.17%
2014–15	25.49	13.04%
2015–16	28.09	12.49%
2016–17	28.15	11.75%
2017–18	30.61	11.17%
2018–19	34.13	11.13%
2019–20	27.95	9.83%
2020–21	31.46	10.85%
2021–22	42.61	12.29%
2022–23	46.99	12.89%

Source: BGMEA

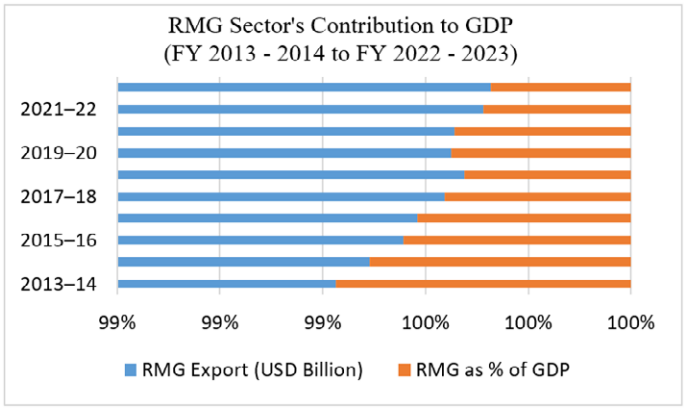


Figure 8. RMG Sector's Contribution to GDP

Table 3. RMG Sector Employment Statistics (FY2013–14 to FY2022–23)

Fiscal Year	Total RMG Workers (Millions)	Female Workers (%)
2013–14	4	60%
2014–15	4	60%
2015–16	4	60%
2016–17	4	60%
2017–18	4	60%
2018–19	4	60%
2019–20	4	60%
2020–21	4.2	59%
2021–22	4.2	59%
2022–23	5	55.60%

Source: BGMEA, BKMEA, FBCCI

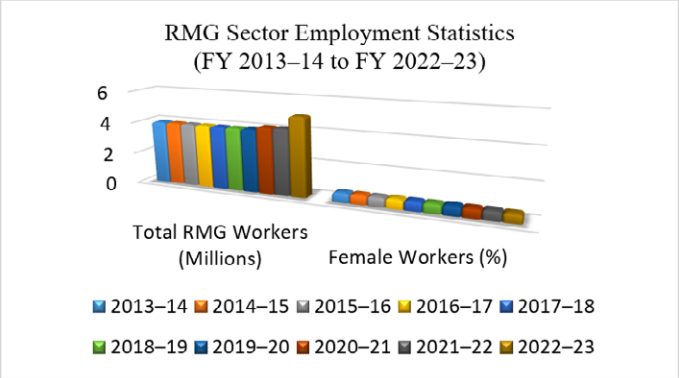


Figure 9. RMG Sector Employment Statistics (FY 2013–14 to FY 2022–23)

In spite of trade policy changes and global economic concerns, Bangladesh's ready-made garment (RMG) industry is still growing and exhibiting resilience as of April 2025. The most recent data available, including market distribution and export numbers, is summarized here.

Table 4. Market Distribution (2024) & Bangladesh RMG Export Performance (2024 to 2025)

Market	Export Value (USD Billion)	Share of Total Exports
European Union - EU	$19.37	50.34%
United States - US	$7.20	18.72%
United Kingdom - UK	$4.30	11.25%
Non Traditional Markets	$6.33	16.46%

Performance Period	Export Value (USD Billion)	Year on Year Growth
FY2024–25 (Jul–Mar)	$30.25	10.84%
FY2024–25 (Jul–Jan)	$23.55	12.00%

Source: BGMEA

4.9. Pharmaceutical (Pharma) Sector

a. Dominance of the Local Market: The domestic pharmaceutical sector is currently self-sufficient, meeting more than 97% of local demand.

b. Growth in Exports: Pharmaceutical exports have expanded to over 150 countries, including regulated markets like the US and EU.

c. Regulatory Compliance: Research and development, Good Manufacturing Practices (GMP) and regulatory approvals (US FDA, UK MHRA) have all contributed to increased credibility internationally.

d. Production and Innovation: With the help of tax breaks and government regulations, the manufacturing of active pharmaceutical ingredients (APIs), biosimilars and high tech generics has increased.

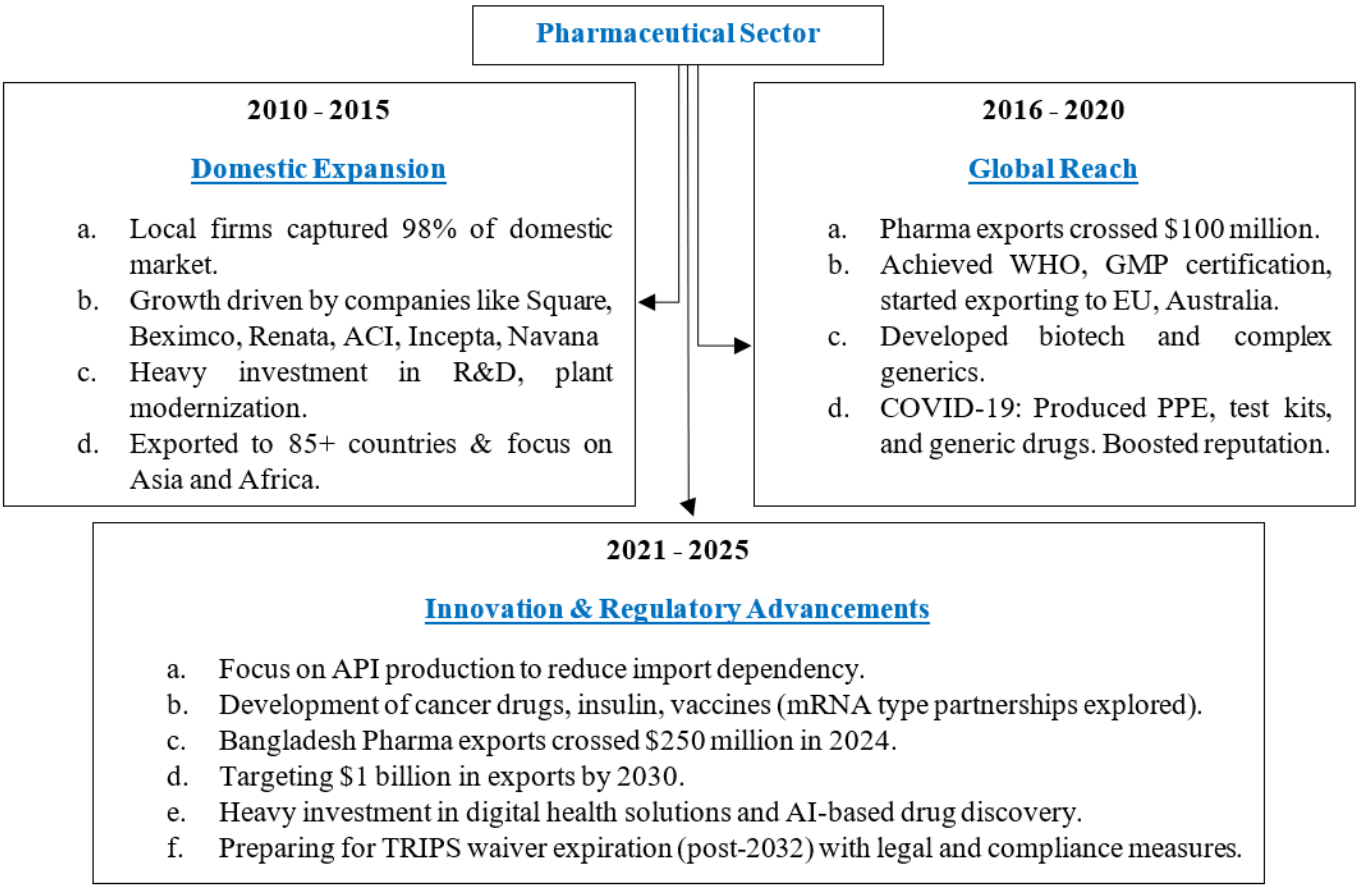


Table 5. Comparative Overview: Pharmaceutical vs. Total Exports

Category	FY 2021 - 2022	FY 2022 - 2023	Year on Year Change
Total Exports	$52.08 Billion	$55.55 Billion	6.67%
Pharmaceutical Exports	$188.78 Million	$175.42 Million	−7.08%
Pharma Share of Total	~0.36%	~0.32%	↓

Table 6. Pharma sector Contribution to GDP over the last few years of Bangladesh

Fiscal Year	GDP Contribution (%)
2016–17	1.85%
2020	~3.00%
2022–23	1.83%

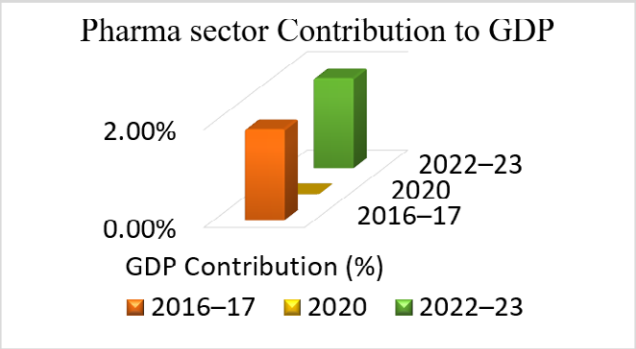


Figure 9. Pharma sector Contribution to GDP

Table 7. Pharma sector Contribution to GDP over the last few years of Bangladesh

Year	Estimated Direct Employment (Approx.)	Estimated Indirect Employment (Approx.)
2019	115,000	300,000
2020	120,000	310,000
2021	125,000	320,000
2022	130,000	330,000
2023	135,000	340,000

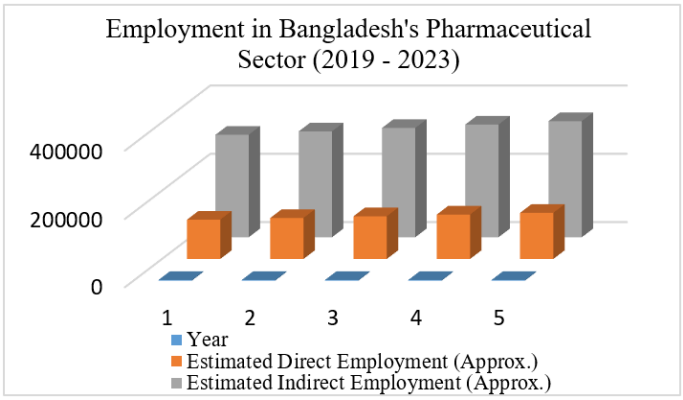


Figure 10. Employment in Bangladesh's Pharmaceutical Sector (2019 - 2023)

Table 8. Market Distribution & Bangladesh Pharma Export Performance

Country	Export Value (USD)	Percentage of Total Exports
Myanmar	$ 25.82 million	14.72%
Sri Lanka	$ 21.91 million	12.49%
United States	$ 15.25 million	8.69%
Philippines	$ 13.02 million	6.64%
Afghanistan	$ 7.63 million	5.07%
Cambodia	$ 5.82 million	3.78%
Nepal	$ 3.80 million	1.23%

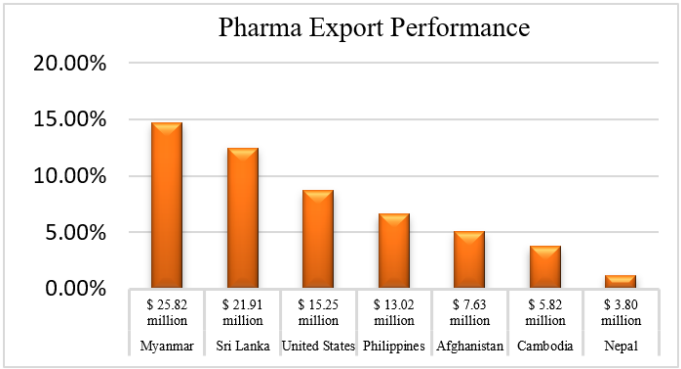
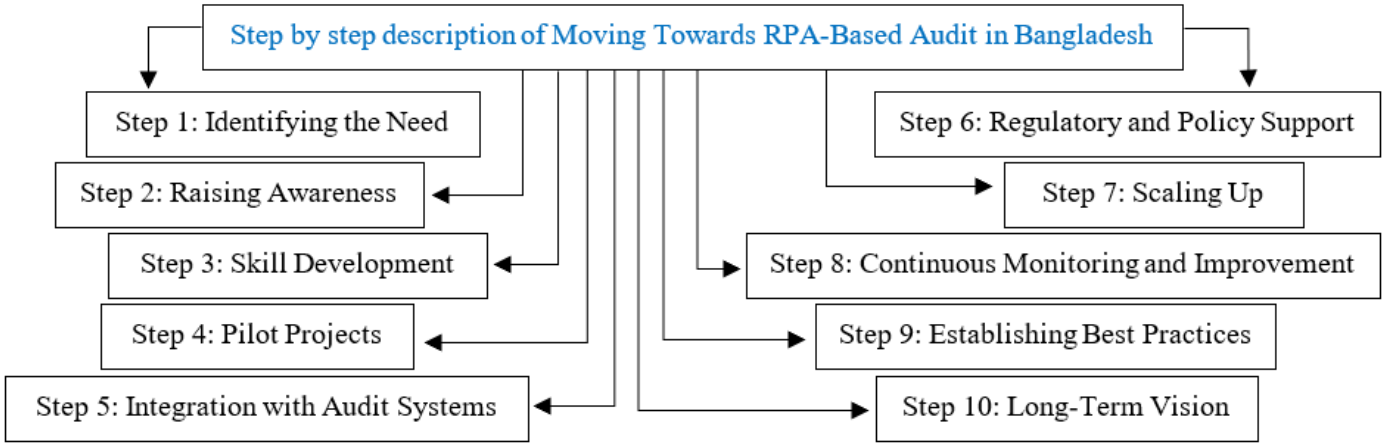


Figure 11. Pharma Export Performance

Together, these sectors (RMG & Pharma) have been pillars of Bangladesh's export led growth, helping to reduce poverty, enhance employment and diversify the economy.

4.10. Transition to bangladesh's rpa-based audit

To enhance auditing's speed, accuracy and efficiency, Bangladesh is steadily using robotic process automation, or RPA. Traditional auditing techniques grow worse at storing massive amounts of data as businesses get bigger and more complex. By automating repetitive tasks like data extraction, pairing, and report preparation, RPA provides a solution. RPA solutions are being investigated by certain audit firms and institutions to improve workflows and lower manual errors, even though adoption is still in its early phases. To fully exploit the benefits of RPA in the audit industry in Bangladesh, effective adoption require awareness, training, or regulatory advice.



4.11. RPA Revenue Testing

In the context of audit, the Revenue Test with RPA (Robotic Process Automation) refers to the use of automation tools to carry out profit related audit activities. Automating the testing of revenue could greatly improve productivity, accuracy and consistency as it is one of the most vital and riskiest facets of financial audits. For revenue testing in an audit, the use of RPA can greatly improve coverage, accuracy and efficiency. Here's a summary of how to use RPA for revenue testing, especially as it comes to audit operations.

4.11.1. The purpose of revenue testing in audits is to confirm that the revenue reported is legitimate and matches actual transactions

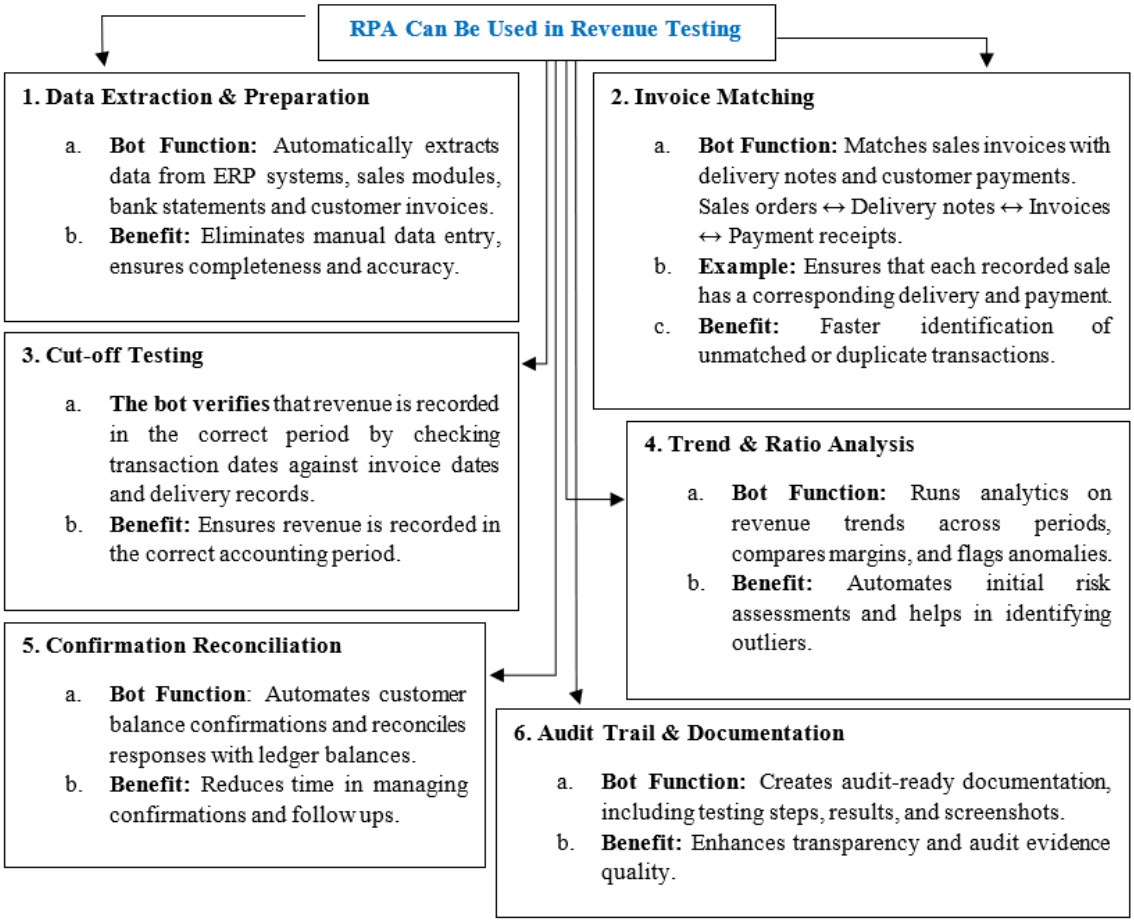
a. All revenue is fully recorded, with exact quantities and accounts.

b. Occurred during the appropriate accounting period and the revenues reported are actual (existent).

c. Occurred during the appropriate time frame (cut-off) and was accurately documented (accuracy)

d. And appropriately labeled (disclosure and presentation).

4.11.2. How RPA Can Be Applied in Revenue Testing



4.11.3 Advantages of RPA, in Revenue Testing an efficiency: Quickens the testing process and minimizes manual labor

a. Accuracy: Reduces human mistake in matching and extracting data.
b. Coverage: Enables 100% testing as opposed to only sampling.
c. Real time monitoring: Bots are capable of doing tests on a daily or weekly basis.
d. Documentation: For each action it takes, RPA keeps thorough logs.

4.11.4. Things to Think About and Difficulties

a. In order to handle complicated revenue recognition requirements (under IFRS 15 or ASC 606), bots must be properly setup.

b. The underlying data's quality is crucial.

c. As systems or procedures change, bots must be updated and maintained.

4.12. Bangladesh audit professional interview or insights on RPA

13 audit professionals from the RMG and pharmaceutical industries were interviewed and surveyed in order to obtain a practical understanding of the state of robotic process automation (RPA) in the audit profession in Bangladesh. Junior audit associates and senior audit managers were among the attendees, offering a wide range of viewpoints on the application of RPA, its difficulties and it's potential.

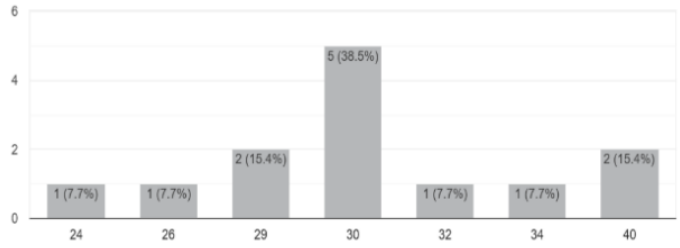


Figure 12. Age of participants

Question: Age of Participants of survey questionnaires
Observation: Out of 13 participants, we found 38.5% are 30 years old & the 15.4% combined 40 years.
Which are professional auditor in RMG & Pharma sector.

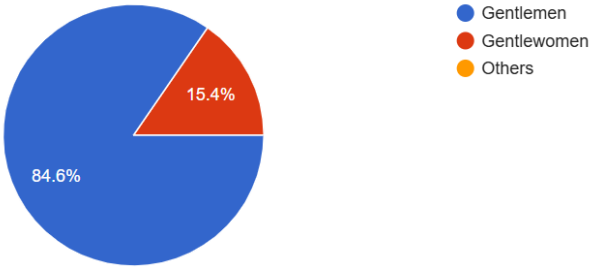


Figure 13. Gender of participants

Question: Participants Gender?
Observation: Here I found, in industry perspective 84.6% auditors are gentlemen & rest of 15.4% are gentlewomen.

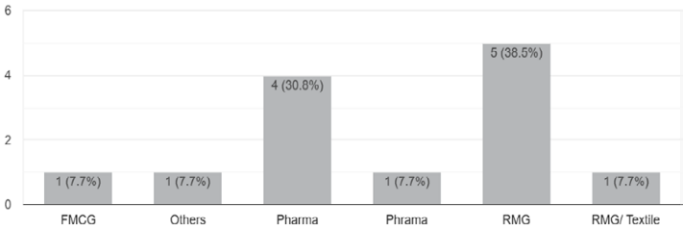


Figure 14. Industry belongs to the participants

Question: Which industry belongs you?
Observation: From the surveying questionnaires, found 38.5% belongs from RMG sectors, 30.8% from Pharma background.

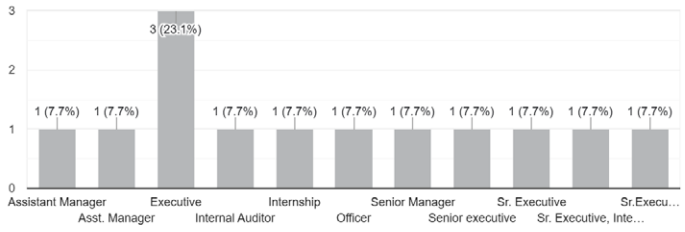


Figure 15. Current role/designation of participants

Question: What is your current role/Designation?
Observation: We trying to understand the number of participants. Where 23.1% are entry label job holder & remain of them are higher management stuff, who take decisions & lead the audit team.

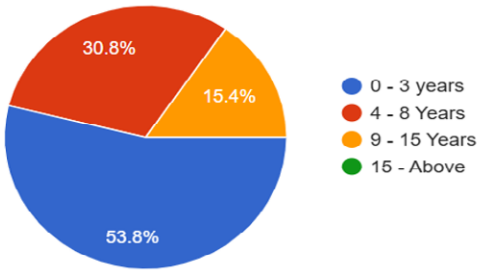


Figure 16. Experience of participants

Question: How many years of experience do you have in auditing?
Observation: According to pie chart, 53.8% are youngest professionals and 30.8% & 15.4% are higher management stuff/ auditors, who leads the audit team as well as industry.

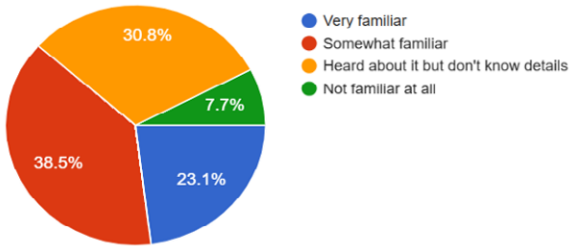


Figure 17. Concept of RPA of participants

Question: How familiar are you with the concept of Robotic Process Automation (RPA)?
Observation: It's really surprising that, 38.5%, & 30.8% rarely know a few about of RPA, 7.7% completely unfamiliar of RPA. Only 23.1% know about RPA which is slightly okay for now.

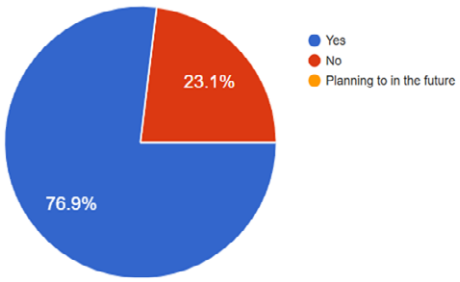


Figure 18. Feeling on RPA of participants

Question: If you found that at least 40% of your work was being completed systematically through RPA (Robotic Process Automation) with accuracy and on time, how would you feel?
Observation: The fact that 23.1% those polled assess the result as "Better" and 76.9% as "Excellence" shows that RPA can be trusted to increase productivity, decrease manual errors and boost performance. It demonstrates that automation is not only satisfying yet going over many people's expectations, which illustrates the need of growing and improving RPA in the firm.

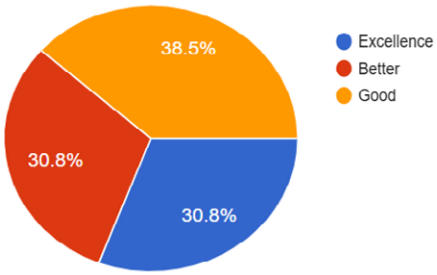


Figure 19. Training or awareness sessions on RPA

Question: Has your organization provided any training or awareness sessions on RPA?
Observation: Only 30.8% indicated that such sessions have already been conducted, while another 30.8% stated that no training has been provided. Interestingly, the largest portion, 38.5%, noted that the organization is planning to introduce RPA training in the future. This indicates that while RPA is beginning to take root, there is still a significant opportunity for organizations to enhance employee readiness and understanding through structured training initiatives.

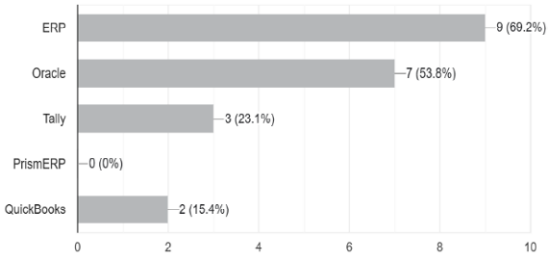


Figure 20. Used software of participants

Question: Which system/software are use in your organization?
Observation: When asked about the systems or software used within the organization, responses revealed a diverse range of tools supporting business operations. ERP systems are the most widely used, reported by 69.2% of respondents, indicating a strong reliance on integrated platforms for managing core business processes. Oracle follows with 53.8%, showcasing its prominence, particularly in larger or more complex organizations. Additionally, 23.1% reported using Tally, and 15.4% mentioned QuickBooks, suggesting that while enterprise level systems are prevalent, some organizations still utilize more specialized or small to medium business oriented software for accounting and financial management.

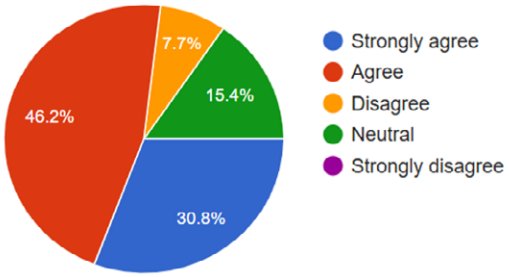


Figure 21. Believe on RPA in future use

Question: Do you believe RPA will significantly change audit practices in Bangladesh over the next 5 years?
Observation: When respondents were asked whether they believe RPA will significantly change audit practices in Bangladesh over the next five years, the majority expressed a positive outlook. 46.2% agreed with the statement, while an additional 30.8% strongly agreed, indicating strong confidence in the transformative potential of RPA in the audit sector. 15.4% remained neutral, suggesting some uncertainty or a wait-and-see approach, and only 7.7% disagreed, reflecting minimal skepticism. Overall, the results highlight a strong belief that RPA is poised to play a critical role in reshaping audit practices in the near future.

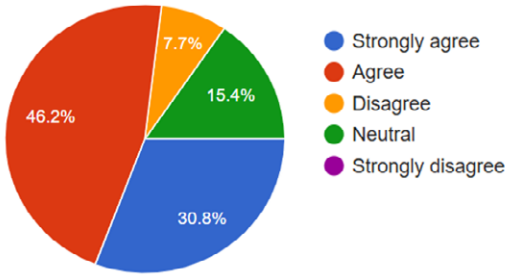


Figure 22. Willing to learn RPA

Question: Would you personally be willing to learn how to use RPA tools to enhance audit work?
Observation: An overwhelming 92.3% of respondents expressed willingness to learn RPA tools to enhance audit work, with 7.7% indicating a tentative interest "Maybe".

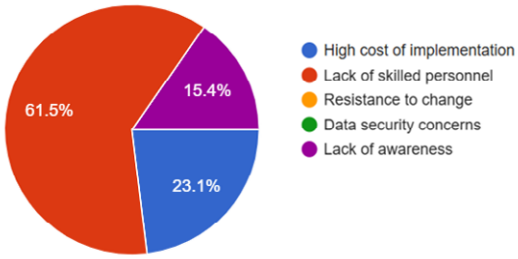


Figure 23. Challenges in adopting RPA in audit

Question: What are the main challenges in adopting RPA in audit?
Observation: The main challenges in adopting RPA in audit, as identified by respondents, include a lack of skilled personnel (61.5%), making it the most significant barrier. This is followed by the high cost of implementation (23.1%) and a lack of awareness (15.4%). These findings highlight the need for targeted training and strategic investment to facilitate smoother RPA adoption in the audit sector.

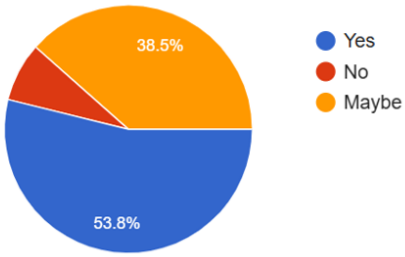


Figure 24. Believe on RPA to replace traditional audit work

Question: Do you believe RPA will replace traditional audit work in the next 5 - 10 years?
Observation: When asked whether RPA will replace traditional audit work in the next 5–10 years, 53.8% of respondents said "Yes", indicating a strong belief in automation's transformative potential, while 38.5% responded "Maybe", reflecting cautious optimism or uncertainty about the extent of this shift.

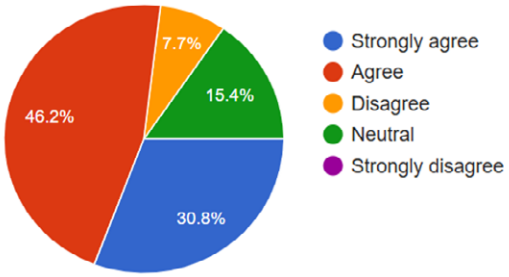


Figure 25. Believe on RPA to enhance eligibility & development

Question: Do you believe, RPA will enhance your eligibility & develop your work efficiency & accuracy.
Observation: if RPA will enhance their eligibility and improve work efficiency and accuracy, 69.2% of respondents said "Yes", showing strong confidence in its positive impact, while 30.8% responded "Maybe", suggesting potential but with some reservations.

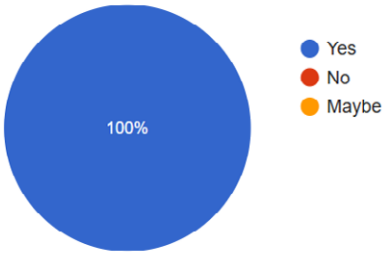


Figure 26. Comfortablity of using RPA

Question: Are you comfortable using RPA for systematic inventory audits and reconciliation reports? It'll save your time & energy.
Observation: When asked about using RPA for systematic inventory audits and reconciliation reports, 100% of respondents expressed comfort and willingness, recognizing its potential to save both time and energy in these repetitive audit tasks.

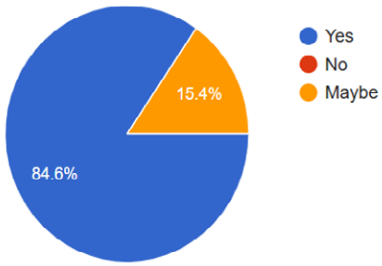


Figure 27. Believe on RPA to replace traditional audit work

Question: Are you comfortable using RPA for systematic audit reports in commercial/SCM bill audits? Cross check, Requisition to CS, PO/WO, Challan, Bills & Accounts parts.
Observation: using RPA for systematic audit reports in commercial or SCM bill audits covering processes like cross checking requisitions to CS, PO/WO, challans, bills and accounts 84.6% of respondents said "Yes", showing strong

comfort with automation in complex workflows, while 15.4% responded “Maybe”, indicating cautious interest.

4.13. Financial aspects for robust adoption of RPA in Bangladesh

4.13.1. Initial Investment Costs

a. Software Licensing Fees: RPA tools like UiPath, Automation Anywhere or Blue Prism require licensing fees, often structured annually or per bot.

b. Infrastructure Costs: Costs for servers, cloud services or hybrid environments to host RPA systems.

c. Consultancy & Implementation Fees: External RPA experts or firms may be needed for design, development and deployment.

d. Customization & Integration Costs: Adapting RPA to work with existing ERP (like SAP, Oracle)

4.13.2. Operational Costs

a. Maintenance & Support: Continuous monitoring, bot maintenance, system updates.

b. Bot License Renewals: Annual or multiyear license renewals and scaling licenses as usage grows.

c. Training Costs: Training internal teams to develop, deploy and maintain bots.

d. Change Management: Investments to manage organizational change

4.13.3. Cost Savings/ROI Analysis

a. Labor Cost Reduction: Automating manual, repetitive supply chain tasks (invoice processing, purchase order management, inventory tracking).

b. Error Reduction: Decrease in manual errors leads to fewer penalties, rework and losses.

c. Cycle Time Reduction: Faster transaction processing improves cash flow and operational efficiency.

d. Better Resource Allocation: Human employees can focus on higher value activities.

e. Compliance Cost Reduction: Improved compliance in procurement and regulatory documentation.

4.13.4. Scalability Financial Planning

a. Pilot vs. Full Scale Deployment Costs: Budgeting for phased implementation rather than a big bang rollout.

b. Elastic Scaling: Financial flexibility to scale bots up or down based on seasonal demand

4.13.5. Risk & Contingency Budgeting

a. Failure Costs: Costs related to bot failures (downtime, recovery, reputational risk).

b. Cybersecurity Investments: Strengthening data protection to handle sensitive supply chain and client information.

c. Backup & Disaster Recovery Costs: Systems must be ready for RPA outages or crashes.

4.13.6. Vendor and Technology Risk Mitigation

a. Vendor Dependence Cost: Diversifying vendors or developing internal capabilities to reduce vendor lock in risks.

b. Upgradation Costs: Regular costs to upgrade RPA tools for better features or regulatory compliance.

4.13.7. Taxation and Incentive Considerations

a. Tax Benefits: Exploring tax incentives on technology investments (if offered by the Bangladesh government for automation/digitalization).

b. Customs Duty/Import Costs: If importing specialized RPA hardware or servers.

4.13.8. Local Factors to Consider (Specific to Bangladesh)

a. Electricity Reliability Costs: Need for UPS, backup power to ensure 24/7 bot operation.

b. Internet Stability Investment: High quality broadband necessary for cloud based RPA solutions.

c. Talent Shortage Costs: Higher salaries for limited local RPA skilled professionals or costs of outsourcing expertise.

4.14. Study of cases

My Experiment with Robotic Process Automation (RPA) in RMG and Pharma Audits in Bangladesh: From Ledgers to Bots. The procedure was primarily manual when begin the studying & ask senior professionals who actually auditing profesion in Bangladesh over a decade ago. It was commonplace to have mountains of paper files, spend hours on Excel, and spend late nights reconciling purchase logs and inventory data, mainly in the pharmaceutical and ready-made garment (RMG) industries. However, things started to change a few years ago. "Automation is coming," "routine tasks will be replaced by bots," and "RPA is the future" were the first rumors to circulate. Like many of my peers, I had concerns. How may a bot comprehend the intricacies of an audit of stock? How would it enforce adherence to DGDA and BSEC regulations or detect irregularities in vendor payments?

Then I met robotic process automation (RPA) for the first times.

4.14.3. The Effect on the Industry

In both industries, the change is becoming apparent: a. RMG businesses now close their books more quickly and with fewer mistakes.

a. Pharma companies can reply to inquiries from regulators in a matter of minutes as opposed to days.

b. The trust of foreign investors and buyers has increased along with the quality of audits.

4.14.4. Looking to the Future

Seeing an RPA powered dashboard in a client's office makes me smile these days. I remember spending those late hours staring at spreadsheets, and I don't miss it. The audit procedure wasn't the only thing altered by RPA. It revolutionized my work as an auditor and aided our sectors in making a daring move toward the digital future.

4.15. RPA areas for future research in audit sector

4.15.1. RPA and Audit Quality Enhancement

a. To what extent does RPA improve audit accuracy, consistency and timeliness?

b. Comparative studies of audits performed with vs. without RPA tools.

4.15.2. Auditor RPA Collaboration Models

a. Optimal models for human bot collaboration in audits.

b. Division of responsibilities between auditors and RPA bots.

4.15.3. RPA in Risk Based Auditing

a. How can RPA assist in dynamic risk assessments and real time audit analytics?

b. RPA driven risk prioritization in high volume transactional environments.

4.15.4. Internal vs. External Audit Automation

a. Differences in RPA adoption and effectiveness between internal and external audits.

b. Role of RPA in continuous auditing and monitoring for internal audit teams.

4.15.5. RPA's Impact on Audit Ethics and Professional Judgment

a. Does automation affect an auditor's exercise of skepticism and independence?

b. Research into overreliance on automation in judgment based audit areas.

4.15.6. Integration of RPA with Audit Data Analytics (ADA)

a. How can RPA be effectively integrated with data analytics for deeper audit insights?

b. Best practices in combining RPA and ADA tools like ACL, IDEA, or Power BI.

4.15.7. Scalability of RPA in Audit Firms

a. What are the scalability challenges of RPA for small and mid-tier audit firms?

b.Case studies on RPA deployment models by firm size.

4.15.8. Regulatory Compliance and Audit Automation

a. Use of RPA in ensuring and testing compliance with audit standards.

b. Auditor responsibilities in validating automated compliance testing.

4.15.9. Training and Curriculum Development

a. How should audit education evolve to include RPA skills?

b. Curriculum design for accounting and auditing students to become RPA literate.

4.15.10. Audit Documentation and RPA

a. Legal and procedural implications of automated audit documentation.

b. Bot generated work papers: Acceptability and review process by regulators.

5. CONCLUSION

The implementation of RPA in Bangladesh's pharmaceutical and RMG audits shows great promise in terms of automating tedious activities, cutting down on errors and facilitating strategic focus. However, obstacles including inadequate IT infrastructure, hefty setup costs and a lack of digital skills impede advancement. These are similar to early worldwide RPA trends, where legislative certainty and focused investment were necessary for success.

To promote adoption:

- Digital compliance frameworks tailored to audits must be established by regulators.
- Businesses should pilot low cost RPA applications and give staff training top priority.
- Leaders in the industry must promote RPA success stories.
- Vendors need to provide scalable, locally relevant tools.

RPA can improve audit reliability, satisfy international standards and future proof Bangladesh's vital export industries with concerted efforts.

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