Pharmaceutical R&D in Bangladesh: Ground Realities and Prospects

Obaida Karim, Sanjida Ahmed Srishti, Nahitun Naher, Syed Masud Ahmed

Centre of Excellence for Health Systems and Universal Health Coverage (CoE-HS&UHC)
BRAC James P Grant School of Public Health, BRAC University

Background of the study

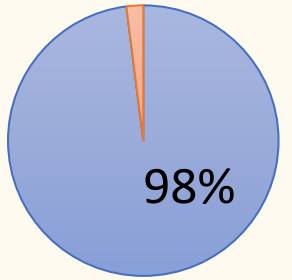
Early bird in developing Drug Policy (1982)

257 licensed pharmaceutical manufacturers (allopathic) are operating in Bangladesh and about **150 are functional**; the top ten companies have 70 % of market share and the top 20 have 78 %.

Third-largest exporter of generic drugs globally. The industry is projected to grow beyond **US$ 6 billion by 2025**, with an export potential of US$ 450 million. It currently **exports to 144 countries** including the UK, EU and USA.

Bangladesh is not **included in patent protection law** by WTO for an extended period of **until 2033.**

Total Drug Sales



Indigenous Pharmaceuticals

Others

Justification

Proactively prepare for the situation of **post-TRIPS waiver**.

Little evidence on this issue.

Mapping the **existing pharmaceutical system** and its current business model is imperative.

Through this study, we aim to map the **current R&D activities and the pharmaceutical industry's business model in Bangladesh.**

Objective

To identify the **main actors, purposes and funding flows** of the pharmaceutical R&D sector

To analyze the **current business model of pharmaceutical industry** and how it impacts the R&D sector

To explore **business models that can spur the innovation** in the pharmaceutical industry

Operational definition

Business Model	The way R&D is financed, organized, facilitated, regulated, and governed.
Pharmaceutical R&D as GPG	Three criteria- Product must first be generated, widely available and accessible
Research & Development	Development of new molecule, new chemical entity or new process
Product Development	Renewing an existing product/ formula

Method

- Key Informant Interviews (18)
- Scoping review (21)
- Database search (3)

Category	Definition	Whom we targeted
Financer (4)	Those who provide push or pull funding for R&D	CEO, Plant Head, Managing director.
Implementer (6)	Those whose organizations are directly involved in the R&D process	Head/Manager of R&D
Facilitator (8)	Those seeking to advance, improve or otherwise shape the R&D process	Academician and policy maker

Findings from Scoping review & KII

Current situation of pharmaceutical R&D

- **Not enough innovative activities**

- **API production**
- **Reverse engineering**
- **Manufacturing more complex products, including biologics and biosimilars**
- **Research on rare diseases and developing novel molecules**
- **The development of a COVID-19 vaccine candidate during the pandemic**
- **Patenting new chemical entity (NCE) in Europe, Australia, Bangalore, India**
- **Collaboration with universities outside Bangladesh**
- **Cutting-edge research by academic researchers in phytochemistry, ayurvedic, herbal medicine, neurology, pharmacology**

"So far, we don't have any innovative product or NCE molecule that we invented. For that invention, actually, the infrastructure and other facilities that are required are not available…so NCE, is not right now happening." ***(KII _Implementer)***

"So, okay. for example, recently with the Bangalore patent office, we have applied for a patent. Before that we have done a patent with the TGA Australia." ***(KII _Implementer)***

"We are developing lead molecules and reporting on their activity worldwide and publishing in high-impact journals. I have developed one anti-protozoal drug….. Here in Bangladesh, we have done so many clinical trials under the observations of doctors.." ***(KII_Facilitator)***

Key focus of pharmaceutical industries

80% of the sampled farms had Below-average levels of innovativeness.

Key focus

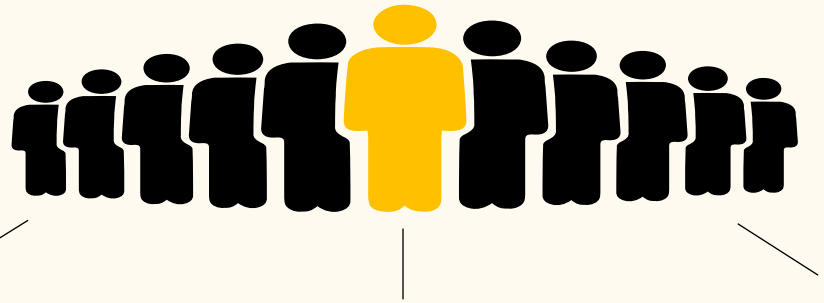
- Provide patients with accessible generic medications-meeting consumers demands
- Generating substantial revenue
- Export pharmaceutical products to other countries: great demand due to low price & meeting international regulatory requirements: US FDA, UK MHRA, TGA
- Antiviral, anticancer, and anti-blood flu medications by large industries

KII interviews

"They study the prevalence of the most occurring disease. In Bangladesh, a study found that 73% of people are suffering from hyperacidity. so we need, esomeprazole, antacid etc.. This is how they are prioritizing." ***(KII_Facilitator)***

"....We have a separate team for product development of the domestic market as well as for non-regulated markets and the regulated markets of other countries such as the European market, UK market as well as Canada, Australia, and some US-based markets. So, we are doing the equivalent product development." ***(KII_Implementer)***

Key Actors in pharmaceutical R&D



Pharmaceutical companies
In-house investors
Marketing department
R&D/PD Department

Government Body
DGDA

Research organizations and universities
ICDDRB
BMRC
IEDCR
Institute of Public Health
National Institute of Cancer Research and Hospital
National Institute of Ophthalmology and Hospital
Few public and private universities

"Basically, DGDA is referred to as a national regulatory authority who controls the importation, exportation, consumption, and distribution of the medicines" ***(KII_Facilitator)***

"We are following IMS data. Suppose we have a product named "X", It has a 200 crore market. As it is already in the market so ABC company has already launched that product. After launching, they identified that their molecule growth was good. Like every year, they can get a good profit. We are not targeting any disease or therapeutic criteria." ***(KII_Financer)***

Fundings in pharmaceutical R&D

Pharmaceutical sector

- No direct involvement of the government in financing R&D for the pharmaceutical companies
- 100 crores BDT investment in 2022 for R&D by one company

Researchers and universities

- Government funds
- External funding from outside like the foreign government like Italy or Japan.

BDT 100 to 300 crore Fund from Govt. (about US$ 94,000 to 280,000 thousand) for health research.

University Grant Commission of Bangladesh

Higher Education Quality Enhancement Project

The Commonwealth

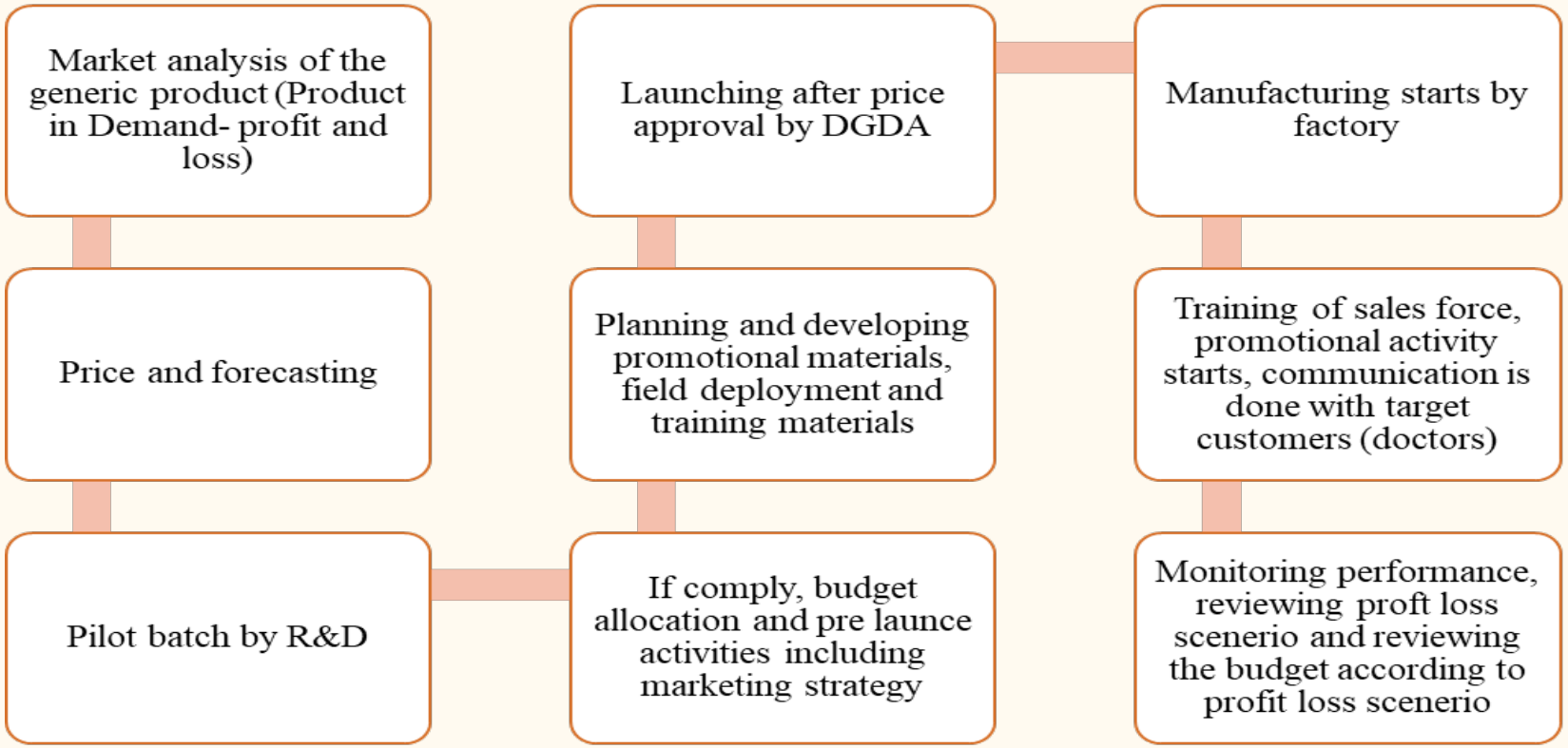
THE WORLD BANK
IBRD • IDA

NIH National Institutes of Health
Turning Discovery Into Health

Ministry of Science and Technology

Ministry of Education

Current Business Model



Easy accessibility of API leads to the burgeoning generic formulation industry

Exporting medicine as a key part of the current business model

Profit centric

Prospect of a new business model for innovation

Compensate the innovator with funds from external sources in exchange for the knowledge generated and made available in the public domain as a public good (i.e., not being subject to a patent)

The stakeholders opinions-

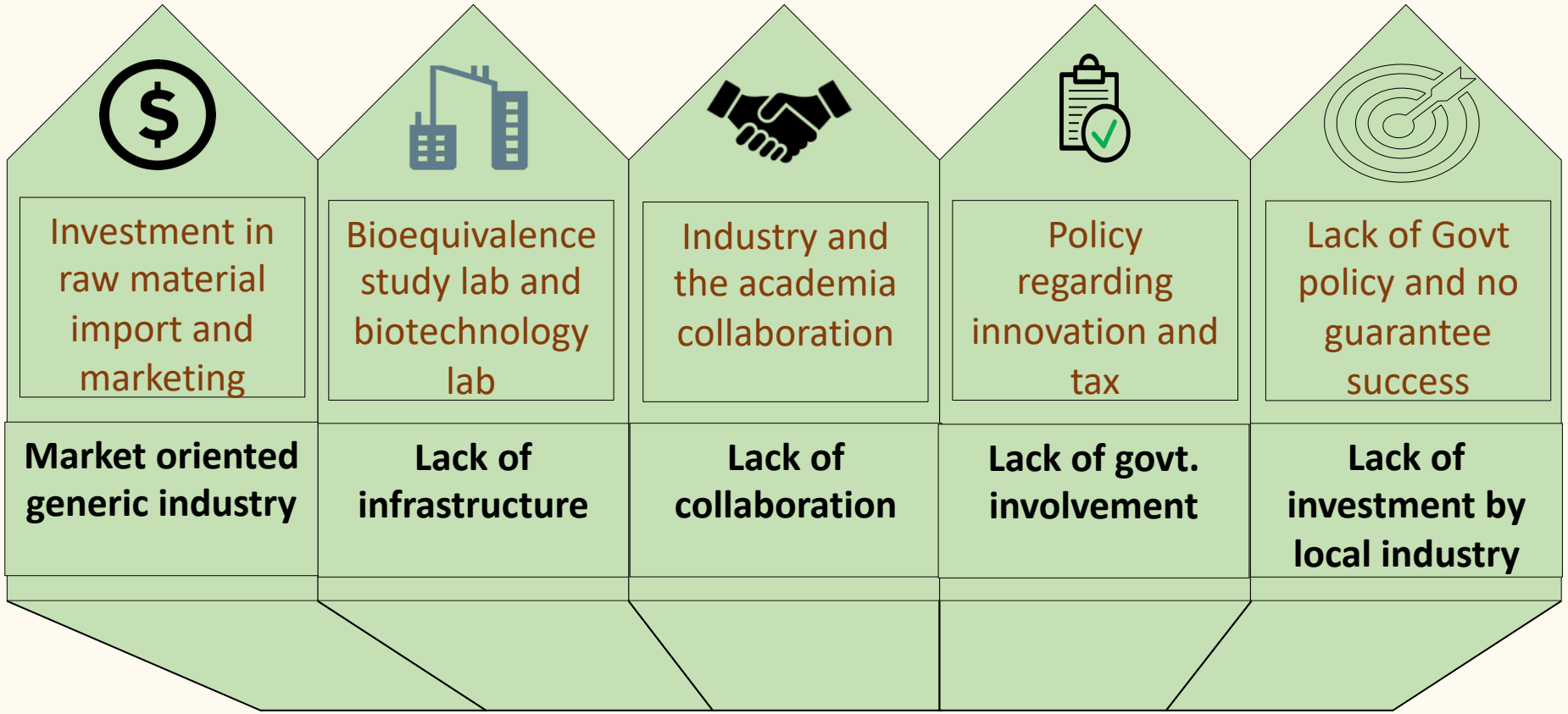
- Feasible and possible
- Researchers will lose interest
- Possibility of misuse
- Model to be built around the business context and claims that only vaccination items could be exempt from the patent policy.

Possible business model for innovation in Bangladesh-

"I would rather try to maintain the United Nations much stronger and let the United Nations invest that amount of money in health research, the total amount of money each and every country is investing, and distribute that money within each and every country. So, each and every country has a vital chance for developing their own product rather than having to look upon another country and waiting for them to give the product." ***(KII_Facilitator)***

"Wealthy nations may have patents while developing countries should be kept patent-free." ***(KII_Facilitator)***

Challenges



"The second problem is Bangladeshi businessmen do not want to take a risk in their whole portfolio and the policymakers cannot have a system where the risk of a company can be protected." ***(KII_Facilitator)***

"Our regulatory guideline has a policy which is that there must be a reference product in the USFDA or Europe UK MHRA; we can only get approval then. If we do any innovation which is not approved in USA, UK or MHRA, they will not give us any approval." ***(KII_Implementer)***

Priority actions

Skill development

Skilled human resources with technical expertise

Infrastructure development

Upgrade laboratory environment

Stakeholders collaboration

Pharma-academia collaboration

Regulatory approach

Dedicated budget for research, policy for tax and patent

"Yes, we have to develop an infrastructure to provide a proper environment for the scientist. It would not be like the facility for commercialization...we need to maintain the standard." ***(KII_Financer)***

"Our government has no plan to revise the policy or work on the existing policies for pharmaceutical research-based activities. This is a very important point." ***(KII_Facilitator)***

Findings from database research

Database Research

01 G-Finder

To track the amount of funding for neglected diseases & emerging infectious diseases

02 ClinicalTrials.gov

03 WHO ICTRP

To explore the current clinical trial condition in Bangladesh

G-Finder Analysis: Total investment in different R&D stages in Bangladesh (2007-2020)

All values are in millions (USD)						
Years	**Basic research**	**Cross-cutting or unspecified**	**Discovery & pre-clinical**	**Post-registration**	**Clinical and field development**	**Total**
2020	6.3	0.5	0.4	<0.1	0	7.3
2019	1.3	3.9	0.1	0.4	0	5.7
2018	1.4	3.9	0	0.5	0	5.8
2017	1.5	0	0	1.8	0	3.3
2016	1.6	0	<0.1	1.5	0	3.1
2015	2.6	0	0.1	0	0	2.8
2014	0	0	0.1	0	0	0.1
2013	0	0	0	0.5	0	0.5
2012	0	1.3	0	0	0	1.3
2011	0	1.9	0	0	0	1.9
2010	<0.1	2.0	0.2	0	0.1	2.5
2009	0.1	2.5	0.1	7.2	0	10
2008	<0.1	3.2	0	0	0	3.2
2007	0	3.7	0	0	0	3.7

Source: G-Finder

Funders & Funding Value in Bangladesh (2007-2020)

All values are in millions (USD)

Funders	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
US NIH	3.1	0.1	<0.1	<0.1	<0.1	0	0	0	0	0	0	0	0	0
Gates Foundation	2.5	1.1	1.1	0.8	1.4	2.5	0	0.5	0.1	0	0.1	7.4	0	0
Wellcome	0.6	0.4	0.4	0.8	0.4	0.2	0	0	0	0	0	0	0	0
UK FCDO	0.5	3.9	3.9	0	0	0	0	0	0	0	0	0	0	0
EC	0.4	0.1	0	0	<0.1	0.1	0.1	0	0	0	0	0	0	0
Effect hope	0.1	0.1	<0.1	0.1	0.1	0	0	0	0	0	0	0	0	0
Global Affairs Canada	<0.1	0	0	0	0	0	0	0	0	<0.1	0.1	0	0	0
Swiss SDC	0	0	0	0	0	0	0	0	0	0	0	0.6	1.1	1.4
Swedish SIDA	0	0	0	0	0	0	0	0	1.2	1.9	1.9	2.0	2.0	2.3
Norwegian SIU	0	0	0	0	0	0	0	0	0	0	<0.1	0.1	<0.1	0
Other	0	0	0.2	1.5	1.1	0	0	0	0	0	0.2	0	0	0
Total	7.3	5.7	5.8	3.3	3.1	2.8	0.1	0.5	1.3	1.9	2.5	10	3.2	3.7

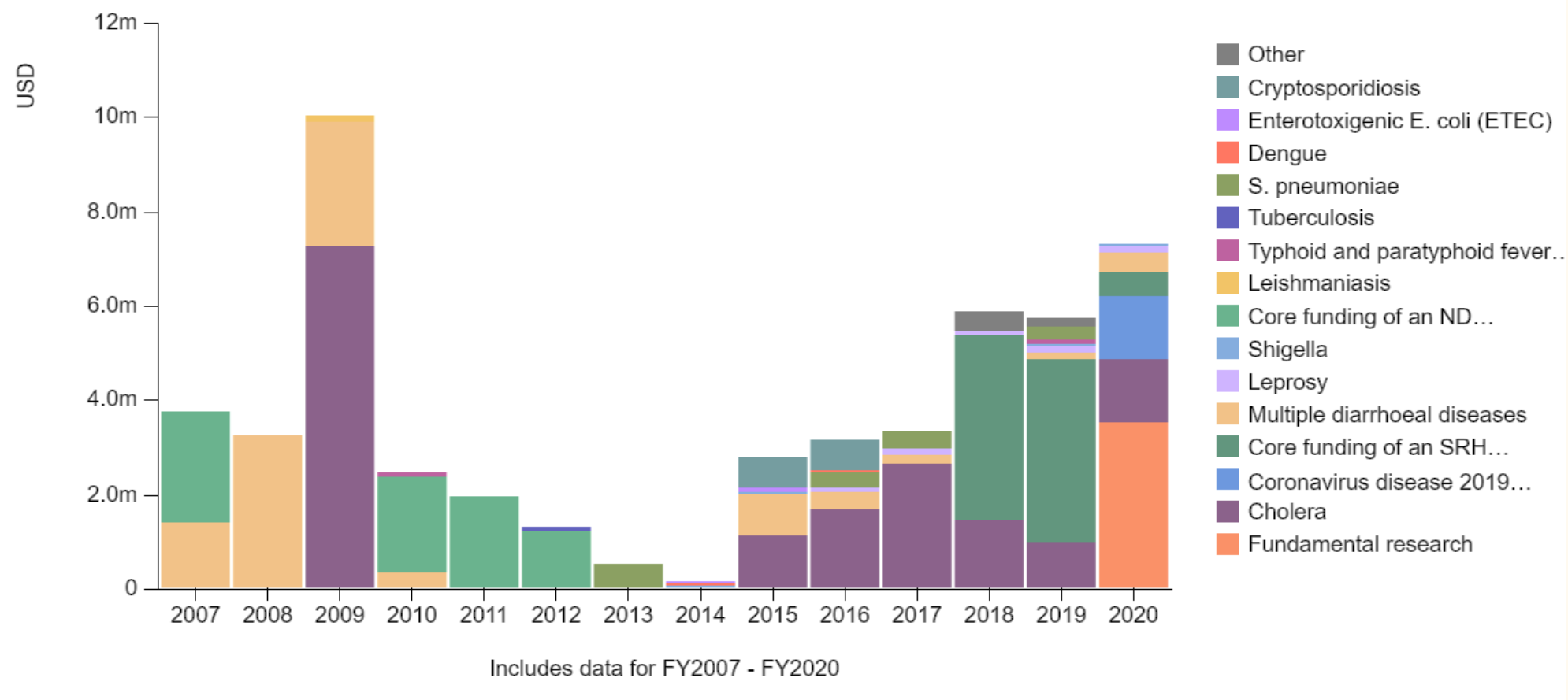
Source: G-Finder

Total Investment in Different Diseases in Bangladesh (2007-2020)

Diseases	Millions (USD)
Cholera	16
Multiple Diarrhoeal diseases	9.6
Core funding for an SRH organization	8.3
Core funding for an NCD organization	7.5
Fundamental research	3.5
S- Pneumonia	1.5
COVID-19	1.3
Cryptoporidiosis	1.3
Leprosy	0.6
Rotavirus	0.5
Shigella	0.3
Typhoid and paratyphoid fever	0.2
Enteroxigenic E.coli	0.1
Leishmariasis	0.1
Tuberculosis	0.1
N. meningitidis	0.1
Dengue	<0.1
Multiple helminth infections	<0.1
Total	51

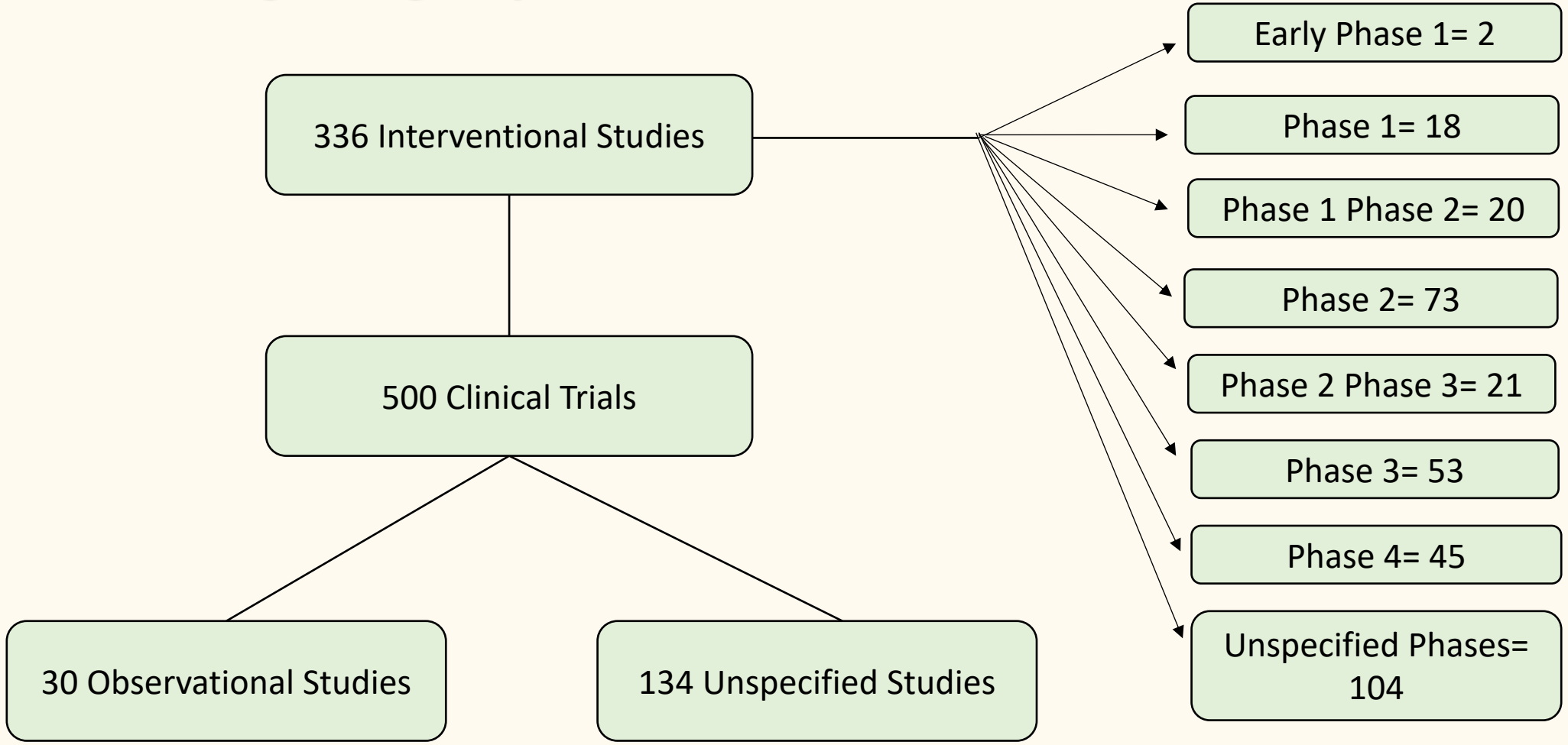
Source: G-Finder

Investments in different diseases over the years in Bangladesh (2007-2020)



Source: G-Finder

Flow chart of the different studies of clinical trials from ClinicalTrials.gov registry



Source: ClinicalTrials.gov

National government organization

National Organisation	Organization Type	Name of the Organisation Conducting Clinical Trials	No. of Clinical Trials	Percent
Government	Research Organisation	Zokiganj Upazila Health Complex	02	0.4
		BRICM	01	0.2
		BMRC	01	0.2
		Bandarban Sadar Hospital	01	0.2
		Maternal and child health training institute (MCHTI)	01	0.2
		Centre for the Rehabilitation of the Paralysed(CRP)	01	0.2
		Child Health Research Foundation (CHRF)	01	0.2
		Upazila Health and Family Planning Office (UHFPO)	01	0.2
	Universities	Bangabandhu Sheikh Mujib Medical University (BSMMU)	91	18.2
		Dhaka Medical College Hospital (DMC)	09	1.8
		Dhaka University (DU)	03	0.6
		Chittagong Medical College Hospital (CMCH)	02	0.4
		Bangladesh University of Engineering and Technology (BUET)	01	0.2

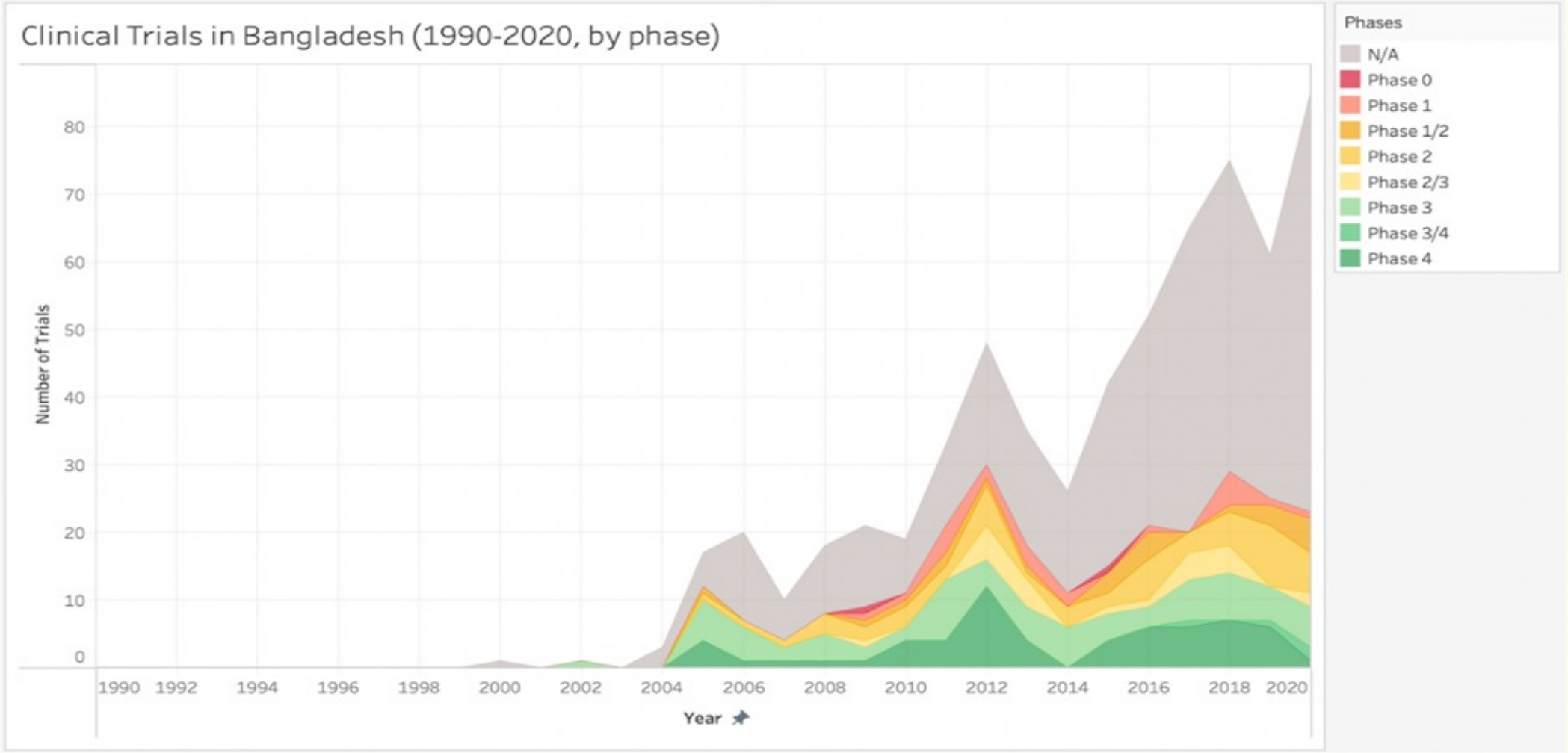
Source: ClinicalTrials.gov

National non-government organization

National Organisation	Organisation Type	Name of the Organisation Conducting Clinical Trials	No. of Clinical Trials	Percent
Non-government	Research Organization	icddr,b	175	35
		BRAC	05	1
		Bangladesh Laser and Cell Surgery Institute and Hospital, Dhaka, Bangladesh	02	0.4
		Bangladesh Reference Institute for Chemical Measurements (BRICM)	01	0.2
		Bangladesh MARIB Bandarban	01	0.2
		BIRDEM General Hospital	01	0.2
		Combined Military Hospital	01	0.2
		UChicago Research Bangladesh	01	0.2
		Stanford University	01	0.2
		Bangladesh Eye Hospital	01	0.2
	Universities	Bangladesh University of Health Sciences (BUHS)	01	0.2
		Community Based Medical College Bangladesh (CBMCB)	01	0.2

Source: ClinicalTrials.gov

Clinical Trials by phase over 1990-2020 in Bangladesh: WHO ICTRP



Source: WHO ICTRP

Conclusions

- Limited involvement of the relevant stakeholders including the government in Pharmaceutical R&D
- No significant industry-academia collaboration
- Self-funded R&D activities in Pharmaceutical Industry
- Mostly focused on Product development
- Not prepared for the Post-TRIPS era

Recommendations

- Prepare for the post-TRIPS era: the industry, the government, including the research community
- Develop and Update regulatory guidelines/laws to facilitate R&D in the public, private, and academia
- Investment in R&D by the public and private sectors; instead of short-term revenue generation, the industry should make investment for future sustainability; a certain proportion of the revenue generated may be ear-marked for R&D
- The government should allocate more resources to the Universities and other research organizations for generating necessary evidence
- Investment for improving infrastructure (e.g. Labs etc.) and human resources (e.g., skill-development training)
- Establish collaboration across relevant sectors (e.g. public-private, industry-academia)

Time is running short, we should start planning for it TODAY!

Short questions

- What does research and development/innovation mean in the pharmaceutical industry and why is it important?
- How alternate approaches for conducting R&D can produce better global public health outcomes?
- What is the current scenario of the pharmaceutical industry in Bangladesh (generic industry, profit-centric business model, drug price, drug quality, less focus on NTD)?
- What is the current situation of clinical trials in Bangladesh (Funders, funding source, funding areas)?
- Is Bangladesh's pharmaceutical industry prepared for the post-TRIPS era?
- What are the limitations and scope of pharmaceutical R&D in Bangladesh?
- Who are the key actors and what role they can play to facilitate pharmaceutical R&D in Bangladesh?

Reading Materials

- Ahmed, S.M. (2020). Research and Innovation in the Bangladesh Pharmaceutical sector. Research and Innovation in the Bangladesh Pharmaceutical sector. Available at: http://syedmasudahmed.blogspot.com/2020/12/research-and-innovation-in-bangladesh_2.html.
- Ala, M. U. (2013). A Firm-level Analysis of the Vulnerability of the Bangladeshi Pharmaceutical Industry to the TRIPS Agreement: Implications for R&D Capability and Technology Transfer. Procedia Economics and Finance, 5, 30–39. https://doi.org/10.1016/s2212-5671(13)00006-3
- Azam, M. M. (2017). The impacts of TRIPS on the pharmaceutical regulation and pricing of drugs in Bangladesh: In search of policy direction. International Journal of Law and Management, 59(3), 376–393. https://doi.org/10.1108/IJLMA-01-2016-0002
- BANGLADESH PHARMA MARKET & REGULATORY REPORT. (2020). [online] Hyderabad: Pharmaceuticals Export Promotion Council of India. Available at: https://pharmexcil.com/uploads/countryreports/Bangladesh_Market_Regulatory_report2020.pdf.
- Chaudhuri, S. (2020). Evolution of the Pharmaceutical Industry Bangladesh, 1982 to 2020. [online] papers.ssrn.com. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3767822#:~:text=Sudip%20Chaudhuri [Accessed 8 Feb. 2023].
- Chowdhury, M. A. A. (2016). TRIPS and Innovative Capacity of Bangladesh's Pharmaceutical Industry: Promotion of Access to Essential Medicine. IIUC Studies, 111–126. https://doi.org/10.3329/iiucs.v10i0.27430
- Nadin, M. M., & Al-Faruk, M. (2015). GROWTH OF PHARMACEUTICAL COMPANY IN BANGLADESH.
- Pal, M. R., Rana, S., & Parvin, R. (2020). Factors influencing research & development expenditures of manufacturing companies of Bangladesh. International Journal of Accounting and Business Finance, 6(2), 33. https://doi.org/10.4038/ijabf.v6i2.70
- Tazin, F. (2016). Pharmaceutical Industry of Bangladesh: Progress and Prospects. The Millennium University Journal, 1(1).

Thank you