



Re-opening the Bangladesh economy: search for a framework using a riskimportance space

Ahsan Senan¹ · Md Oliur Rahman Tarek² · Sajid Amit² · Imran Rahman³ · Abdulla - Al Kafy^{4,5}

Received: 1 April 2022 / Revised: 22 April 2022 / Accepted: 23 April 2022 / Published online: 17 May 2022
© The Author(s), under exclusive licence to Korean Spatial Information Society 2022

Abstract

The novel coronavirus has infected more than 50 million people worldwide. Countries that have been on lockdown for more than three months have partially started to reopen their economies, including Bangladesh. This study aims to assess the reopening policies in Bangladesh by mapping the economic sectors in a risk-importance space and using that to develop a phased reopening strategy. This study conducted 100 expert interviews to identify sectors critical to the reopening of the economy and sectors that carry high transmission risks of the disease. The convenience sampling and snowball method were applied to reach the economic sector experts. Quadrant analysis was applied to classify sectors according to their importance to the economy and propensity to spread the disease. Pharmaceuticals and grocery have been identified as allowed sectors due to their contribution to the economy but pose relatively less risk of spreading COVID-19, whereas RMG and other exports identify as alert sectors. Based on findings, a sector-based, three-phase reopening strategy has been proposed for the economy that might prevent the spreading of COVID-19. The proposed framework can act as a guiding principle for any country to offer a step by step reopening strategy.

Keywords COVID-19 · Lockdown · Re-opening · Quadrant Analysis · Framework

1 Introduction

A coronavirus lockdown was imposed on Bangladesh on March 17, 2020,, partially ending on May 31, 2020. The lifting of lockdown (on 14 July 2021) was announced by the Cabinet Division of the Government on 13 July 2021. The most prominent advisory body within the government

includes the COVID-19 National Technical Advisory Committee (NTAC). Interestingly, NTAC has argued for a continuation of the hard lockdown scenario, both before and after the decision to lift the lockdown has been announced.

This is not a complete reopening yet—area-wise lockdowns continue, large shopping malls are operating in a limited capacity, education institutions are closed, as are many restaurants and venues where people congregate *en masse*. The city's wards in which the infection rate goes above a certain level are being sequestered and put under a hard lockdown. Officially, the government has continued to instruct citizens to avoid going out unless necessary. This decision to partially reopen the economy from the beginning of June coincides with similar decisions taken by countries worldwide. But the COVID-19 situation is not playing out in the same timeline in all countries, and there have been expert opinions suggesting that the lockdown in Bangladesh, which came too late, may have ended too soon [1].

Most of the countries that are reopening their economies are either beyond the peak infection point, as measured by the number of new daily infections detected, or in some cases, have had no new virus infections for some time. By contrast, Bangladesh decided to lift the lockdown while the

✉ Abdulla - Al Kafy
abdulla-al.kafy@localpathways.org
https://abdullaalkafy.com/

¹ Department of Economics and Social Sciences, School of Humanities and Social Sciences, BRAC University, Dhaka, Bangladesh
² Center for Enterprise and Society, University of Liberal Arts of Bangladesh (ULAB), Dhaka, Bangladesh
³ Board of Trustees, University of Liberal Arts of Bangladesh (ULAB), Dhaka, Bangladesh
⁴ ICLEI South Asia, Rajshahi City Corporation, 6203 Rajshahi, Bangladesh
⁵ Department of Urban & Regional Planning, Rajshahi University of Engineering & Technology (RUET), 6204 Rajshahi, Bangladesh

number of daily new infections was increasing rapidly and has continued to increase since (same is true for neighbours India and Pakistan as well). There is an apparent lack of a long-term multi-phased reopening plan.

To cite the example of Singapore, the government has articulated a three-stage reopening plan, *with an* explicit understanding that these steps may be rolled-back quickly if there are instances of new outbreaks [2]. Qatar, similarly, has developed a four-stage reopening plan [3]. In Bangladesh, however, certain industries have been allowed to reopen based on how critical they are to the economy, while others have not. But a careful consideration or framework with which these decisions are being made is missing.

Moving away from a “hard” lockdown scenario, the government initiated a “soft” lockdown approach in June that locks down a ward area if its infection rate exceeds 40 in 100,000 [4]. These wards will be deemed as the Red Zone and movements will be severely restricted. If the infection rate is less than 3 in 100,000, the ward will be considered a Green Zone and be allowed relatively free movement. Anything in between will be an Orange Zone with some restrictions on movement. In a manner of comparison, Germany has plans to re-impose lockdown in areas that experience infection rates above 50 in 100,000 [5]. This colour-coded zonal-lockdown system implies a more granular approach than the imposed lockdown and may work better. India followed a similar scheme and the growth in their daily infection count has continued to increase exponentially by the end of July. The persistence of the disease in this region may be due to gaps in the lockdown strategy or in some cases, the absence thereof.

Honing in on Bangladesh specifically, the lives versus livelihood argument are weak. In Bangladesh the size of marginal communities is enormous—an astoundingly high 87% of workers in Bangladesh are employed in the informal sector [6]. When the economy is not open, these people are not working. These people are not drawing monthly checks from their employers to keep working from home and they do not have access to banking services, let alone savings. A recent study found that 47.3 million extremely poor people in Bangladesh are at high economic risk due to COVID-19 [7]. The average household income loss between February and May has been 74.0%. The poverty rate is expected to jump up from 21% to over 35%. A very modest assistance program of only half the monthly lower-poverty line amount to only half the economically vulnerable population has been estimated as at least US\$330 million monthly [8].

In terms of land area, Bangladesh is the 92th largest country globally. However, the country’s total population is 161 million, which is nearly 2.2% of the global population, making Bangladesh one of the most densely populated countries in the world [9]. The country’s total fertility

rate has come down in recent years and currently stands at 2.1, which is close to the replacement rate. Population demographics is overwhelmingly young, with almost three-quarter of the population younger than 40 years of age and a median age of only 27. Life expectancy at birth is 72.7 years. The last decades have seen high and persistent growth, averaging around 6–7 per cent GDP growth per year. In 2019, the GDP of Bangladesh had exceeded US\$300 billion, and GDP per capita has recently exceeded the level at regional countries such as India and Pakistan, even though problems such as despite poor infrastructure, internal corruption, insufficient resources and power supply, and slow implementations of economic reforms and public policies persist. In addition, Bangladesh is one of the most vulnerable countries to climate change.

According to the Labor Force Survey Report (2016-17) of Bangladesh, total employment in the number is 63.5 million, out of which 20 million are female. In recent years, a massive gap in the labour force participation rate between males (81.7%) and females (33.5%) has narrowed and showed signs of further narrowing until the pandemic hit. Despite impressive development in recent years, agriculture continues to dominate employment patterns [10], with more than 40% of workers employed in that sector (although a similar number of people are now employed in the service sector as well). The informal sector dominates, employing more than 85% of the people. In addition, around 7.5 million Bangladeshis live abroad (the sixth highest globally), and remittance contributions are over 5% of GDP, amounting to over US\$15 billion annually. This figure increased during the pandemic. The ready-made garments (RMG) industry is the major export earning sector contributing over 80% of export earnings 12% of the country’s GDP and employing almost five million people in 2018. Major imported goods are rice, wheat, cotton, soyabean oil, cement, pig iron, kerosene, steel etc. Other major export items include textiles, jute, tea, newsprint, frozen shrimp etc.

It is obvious that Bangladesh can ill-afford to keep its economy in a state of lockdown for as long as some developed countries may be able to [11]. There are genuine and valid grievances about the timing of lifting the lockdown in Bangladesh (even as experts were saying that it was time to impose an even stricter, complete lockdown). But it goes to reason that any eventual reopening was always going to come before the pandemic was well under the authorities’ control. This study will identify the critically important sectors for Bangladesh’s economy and assess which sectors have high/low risks of spreading the disease. In addition, based on the above and international best practices, develop a phased, multi-level roadmap for reopening the economy, with provisions for rolling back the steps if new outbreaks begin to appear.

A number of academic works have taken a more focused approach and investigated specific sectors (e.g. education [11], tourism [12], etc.) in order to inform reopening policies. The use of mathematical and epidemiological models to guide reopening policies is noticeable in academic research [23], [24]. However, a clear distinction can be made among these studies based on whether or not economic considerations have been taken into account in the development of models. While some studies have been restricted to variables other than the economic ones in the reopening modelling, few studies have taken into consideration economic sectors in the models to guide reopening policies [25],[26],[27],[28],[29]. This distinction is important since formulating a prudent policy for the reopening of the economy must include economic considerations, such as GDP, to risk trade-offs [13]. Varying levels of supply and demand shocks, level of social contact required in operations, diverse demographic characteristics in each sector, etc. may explain the need for varying policy interventions for reopening different economic sectors. Scholars have also attempted to provide reopening frameworks for a large pool of economic sectors on a more macro level [30]. A framework for reopening the economic sectors of Switzerland in 3 phases has been developed, described as “sectoral waves” [15]. In this framework, criteria such as sector’s capacity for remote work, its added value and employment, and the level of social interaction required in operations have been used to guide decisions on which sectors to reopen in which phases [14]. Other scholars, too, have given the emphasis on the economic sectors as part of the re-economic policies. One framework considers the virus spread pressure index’ and the value-added effect of lifting restrictions on the sectors to guide the reopening of Denmark’s economy [25]. Mapping the sectors based on these factors helps to visualize which sectors, compared to their peers, offer greater utility if they reopen in earlier phases [25].

This paper offers a reopening framework for different economic sectors of Bangladesh. While the scholarly works discussed above have made praiseworthy attempts, replication of the same in the context of Bangladesh might not be realistic [31]. For example, any study that seeks to inform reopening policies in Bangladesh based on public sentiment analysis of the social media data may suffer from non-representative insights due to low (as low as 25%) internet penetration in Bangladesh. On the other hand, formulating reopening policies based on sectors’ technological capacity for remote work [15] is not realistic in the context of Bangladesh due to its behemoth informal sector, which comprises almost 99% of the country’s total number of enterprises.

The framework developed here resembles the framework suggested by Andersen in 2020 [25]. However, it has a significant departure based on the data used to measure risks

and the economic importance of different sectors [25]. The framework in this paper has utilized perception scores of 100 experts and leaders in measuring the sectors’ perceived risks and critical importance. To the authors’ best knowledge, no such study exists that offers a reopening framework based on the opinions of such a large pool of experts. This paper is also one of the first that offers a reopening framework in the context of Bangladesh.

2 Method

Bangladesh has not yet a tried and tested roadmap to safely reopen the economy. Almost no country’s reopening plans have gone perfectly. However, one common denominator from most of the re-openings so far has been their staggering nature. Critically essential sectors have been given permission to begin operations first and sectors with a high risk of spreading the disease have remained closed. In Bangladesh, grocery stores, for example, have been allowed to remain open during the pandemic by and large. Retail stores that were closed earlier have started to reopen, not just in Bangladesh but also in other countries. For most countries, sporting events have been on pause, with a handful of countries experimenting with sporting events with empty stadiums (mainly to not renege on lucrative broadcasting contracts). Countries have had to individually identify their vital sectors, assess the risks of viral transmission in their standard modes of operation, and decide which sectors to reopen and which sectors to keep under lockdown for the time being.

The authors of this study undertook a mission to figure out what sectors are of critical importance to the economy of Bangladesh and which of these sectors also carry with it the threat of high risk of COVID-19 transmission. The idea is that by mapping the sectors of the economy on a risk-importance space, we would establish a framework for deciding which sectors to provisionally open and just how strict the guidelines for each sector that is being allowed to reopen should be.

We reached out to 100 experts through online platforms: entrepreneurs, senior leaders and analysts, for their opinions on which sectors are critical to the reopening of the economy and which sectors may be the most prone to transmission risk. The online expert interviews were conducted following a convenience sampling method, supplemented by a snowball method to reach more experts from more sectors. The questions include the risky sectors with regard to the risk of transmission of COVID-19 at the place of work, critical sectors for the economy or livelihoods in Bangladesh and effective strategies to reopen Bangladesh’s economy by considering the most critical sectors were asked to

the experts. A small pilot questionnaire was first deployed with 20 experts to confirm the industry classification below. The sectors are listed in Table 1.

During the interviews, each expert was asked to score specific sectors of Bangladesh out of 5 according to their critical importance (CI) to the Bangladesh economy (1 indicating not important and 5 indicating very important) and the threats of Covid-19 transmission risk (TR) if they were reopened (1 indicating not much risk of transmission and 5 indicating very high risk of transmission). Using the scores assigned by the experts, we calculated the following averages using **Eqs 1 and 2**

Table 1 Important Sectors of Bangladesh

1. Pharmaceuticals	2. eCommerce	3. Online Learning	4. Groceries
5. Banks	6. Services ¹	7. Manufacturing ²	8. Real Estate
9. RMG ³	10. Retail ⁴	11. Other Exports ⁵	12. Public Transport
13. Markets/bazaars	14. Aviation	15. Hotels	16. Restaurants
17. Malls			

Notes:

¹Services include government services, corporate services, NGO services, etc.

²Manufacturing includes cement, ceramics, fast-moving consumer goods, tobacco, etc.

³Ready-made garments (accounts for more than 80% of Bangladesh's export revenue)

⁴Retail includes boutiques, bookstores, electronics, etc.

⁵Other Exports include leather, jute, shrimp, etc.

Table 2 Average and Normalized scores for each sector

Sector	CI_j	TR_j	CI_j^i	TR_j^i
	Raw Score		Normalized Score	
Pharmaceuticals	2.63	4.50	0.31	0.82
eCommerce	2.16	3.80	0.16	0.38
Online learning	1.66	3.19	0.00	0.00
Groceries	3.32	4.12	0.52	0.58
Banks	4.19	4.77	0.80	0.99
Services	3.79	4.33	0.67	0.71
Manufacturing	3.95	4.22	0.72	0.64
Real Estate	3.59	3.84	0.61	0.41
RMG	4.55	4.79	0.91	1.00
Retail	3.71	3.86	0.65	0.42
Other Exports	4.45	4.55	0.88	0.85
Public Transport	4.83	4.39	1.00	0.75
Markets/Bazars	4.76	4.22	0.98	0.64
Aviation	4.54	3.80	0.91	0.38
Hotels	4.11	3.28	0.77	0.06
Restaurants	4.49	3.57	0.89	0.24
Malls	4.76	3.51	0.98	0.20
Average	4.04	3.85	0.53	0.69

$$CI_j = \frac{1}{n} \sum_{i=1}^n CI_{ij}; (i = 1, 2 \dots 100) \tag{1}$$

$$TR_j = \frac{1}{n} \sum_{i=1}^n TR_{ij}; (i = 1, 2 \dots 100) \tag{2}$$

Where CI_j refers to the average score given to the critical importance of sector j by experts $i = 1, 2, 3, \dots 100$, and TR_j refers to the average score given to the transmission of risk of sector j by experts $i = 1, 2, 3, \dots 100$. In order to facilitate inter-sector comparison, feature-scaling was applied to these average scores, CI_j (**Equ 3**) and TR_j (**Equ 4**), to re-scale the values within the range $CI_j, TR_j \in [0, 1] \forall j$ such that:

$$CI_j^i = \frac{CI_j - \min\{CI_j\}}{\max\{CI_j\} - \min\{CI_j\}} \tag{3}$$

$$TR_j^i = \frac{TR_j - \min\{TR_j\}}{\max\{TR_j\} - \min\{TR_j\}} \tag{4}$$

These normalized scores, CI_j^i and TR_j^i , were plotted on a risk-importance scale.

The research team believes this to be a novel method of analysing decision-making by projecting proposed activities onto a risk-importance space. The perceived risks of a proposed activity—reopening of a particular sector in Bangladesh, in this case—are captured by the transmission risk index of that sector. The perceived importance of a proposed activity is captured by the critical importance index of that sector. A key benefit of this method is that we do not end up with a simple binary approval or rejection of a proposed activity. By making use of a risk-reward space and closely analysing the score of a proposed activity on each of the two indices, it is possible to arrive at a number of different and nuanced decisions, as discussed in the next section. To the extent of the authors' knowledge, no similar perceived risk-importance space has not been used in the literature to conduct this type of pandemic-time analysis of decision-making.

The findings are not entirely unexpected. Export-oriented sectors, such as RMG, leather, jute, shrimp, etc., are considered the most critical sectors for Bangladesh's economy, along with banking services and public transport. What is, however, worrying is that these are also the high-risk sectors. The sectors that are critical for the economy and need to reopen are also the sectors that are expected to spread COVID-19 the most. Other sectors, such as Online Learning and eCommerce, posing relatively little threat of transmission of the disease, can even use the COVID-19 lockdown as an opportunity to expand and grow and increase their

market relevance (Fig. 1). We are going to look into each of these sub-groups of sectors in some detail. CI_j and TR_j scores of each sector are listed in Table 2.

3 Results and discussion

3.1 The framework for analysis

The framework used for analysis follows a Quadrant Analysis methodology (Fig. 2). The sectors are divided into four categories based on their CI and TR scores. This subdivision of sectors allows us to comment on the relative importance of a sector to the economy, the necessity of their reopening, and the level of strictness of the safety guidelines that should be developed and maintained for each sector.

3.1.1 Alert sectors

Sectors that are vital for the economy yet carry a high risk of transmitting the disease with it (RMG and Other Exports, Banks, etc.) are the “Alert Sectors”. If the economy is reopening, it is to let these specific sectors to start their operations again. However, it is essential to maintain a high level of alertness and vigilance. Strict guidelines must be developed by an appropriate authority and implemented without excuse. Failure to do so will not only lead to a likely second-wave of COVID-19 cases but also shut down these vital sectors again, exacerbating the harm. In a later section, we will discuss the international best practices to reopen the economy, which may inform the guidelines that these Alert Sectors in Bangladesh should follow.

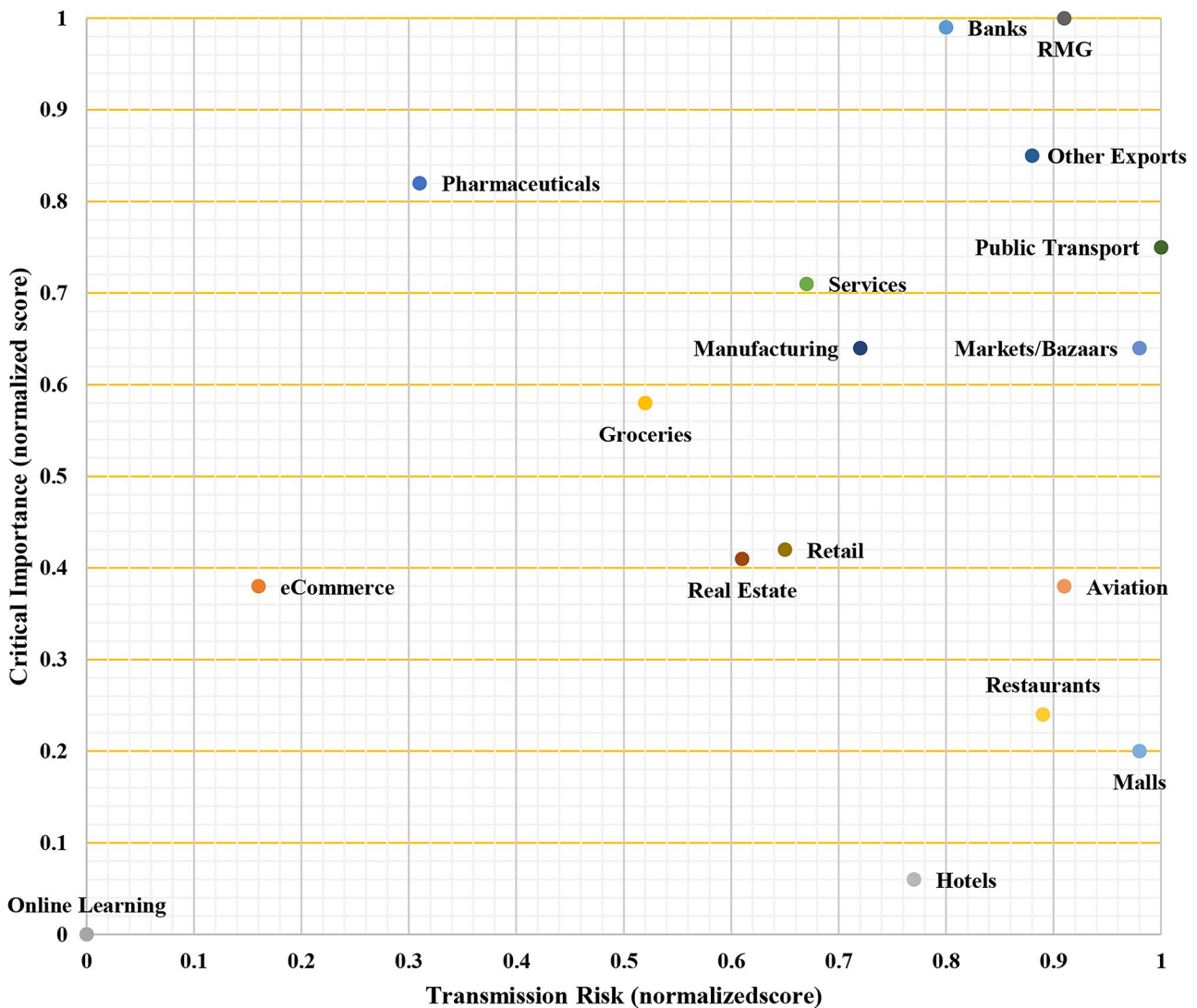


Fig. 1 Reopening the Bangladesh economy: TR vs. CI

Fig. 2 To open or not: A quadrant analysis of Sectors

<p>Allow Sectors</p> <p>High importance ($CI'_j > 0.5$) low-risk ($TR'_j < 0.5$)</p>	<p>Alert Sectors</p> <p>High importance ($CI'_j > 0.5$) high-risk ($TR'_j > 0.5$)</p>
<p>Advance Sectors</p> <p>Low importance ($CI'_j < 0.5$) low-risk ($TR'_j < 0.5$)</p>	<p>Avoid Sectors</p> <p>Low importance ($CI'_j < 0.5$) high-risk ($TR'_j > 0.5$)</p>

3.1.2 Allow sectors

Sectors that are important for the economy but pose relatively less risk of spreading the disease (for example, Pharmaceuticals; Grocery narrowly misses the cut-off point numerically but may be considered here still) are the “Allow Sectors”. For a large part, these sectors have been allowed to remain open during the lockdown due to their importance and are yet to be identified as vectors of spreading the disease. As a result, they could be just allowed to continue operating as usual (standard health guidelines still apply), and if possible, their modes of operations may be studied in detail to extract learnings for other sectors to adopt.

3.1.3 Advance sectors

Sectors that are of low importance to the economy and pose a low risk are the “Advance Sectors”. This includes the eLearning and eCommerce sectors. The University Grant Commission’s decision to allow the summer 2020 semester for both public and private universities in Bangladesh may be a catalyst for eLearning in Bangladesh. At least at the higher and tertiary levels, students and educators worldwide have embraced the move toward Online Learning. COVID-19 merely makes adoption an immediate necessity for most educational institutions rather than gradually implemented over many years. The same is true for the eCommerce sector. The enforcement of social distancing, lockdowns and other measures has led consumers to ramp up online shopping, social media use, internet telephony and teleconferencing, and streaming of videos and films. This is the next logical step, and movement away from physical stores toward eCommerce was already happening in many ways. COVID-19 has catalyzed this process. These Advance

Sectors represent the way forward for the economy, and they should be incentivized and encouraged to expand their operations.

3.1.4 Avoid sectors

Finally, low-priority and high-risk sectors (Hotels, Malls, Restaurants, etc.) are the “Avoid” Sectors. Their cost-benefit ratio is high, and they should be low on the government’s list of priority sectors to reopen and be avoided altogether during these early days. However, for Restaurants, for example, all that the lockdown means is that their dine-in facilities have to shut down. But they can pro-actively explore new avenues to engage with clients. This need not only be limited to adopting eCommerce and delivering orders directly to the customers’ homes. Restaurants can go further by redesigning their menu and pricing strategies to reflect this new state of operation for them. Selling batches of “frozen” versions of popular dishes or other unique ingredients, condiments, al fresco dining, etc., may prove to be a success with customers well. For large malls, they are facilitating a unified umbrella of eCommerce facilities (including online space to showcase wares, means of engaging with prospective clients, access to delivery services, etc.) to all the retailers under its roof can take them from being in a state of complete lockdown to a state of partial reopening without increasing the risk of infection to the economy.

Now that we have identified which sectors are safe to reopen, allowed to stay open, or even encouraged to expand—and which sectors to keep under lockdown—we can begin our discussion on reopening strategies. Our focus, for obvious reasons, will be on the safe reopening and operation of Alert Sectors. The Allow Sectors are already doing fine without needing interventions. And as discussed,

barring any impediments, the Advance Sectors also seem to be doing well independently.

3.2 Reopening the economy

We are proposing a three-phase reopening strategy for Bangladesh (Table 3). In the first phase, Alert, Advance, and Allow Sectors will be allowed to operate. The Alert Sectors include RMG and other export-oriented sectors, Banks, and Public Transport. Different sectors will need different safety guidelines, which will be discussed below. The Advance Sectors, including Online Education and eCommerce, owing much to their low-risk index, do not require strict health and safety guidelines for their operations. We will discuss some general health and safety guidelines that should be followed, especially for eCommerce couriers. The Allow Sectors are already operational, and we may encourage a business-as-usual scenario for them. Avoid Sectors, in their traditional mode of operation, remain under complete lockdown. However, there are opportunities for them to expand the types of services they provide, allowing them to remain at least partially open.

In the second phase, once the spread of the disease is under control, Avoid Sectors, such as malls, restaurants, hotels, aviation, etc., may be allowed to open. It is still too soon for Bangladesh to speculate on when that may be. Once the peak-infection point is reached and daily infection numbers begin to fall, a concrete timeline may be developed. During this time, for certain Avoid Sectors such as restaurants, malls, small boutiques and retailers, eCommerce can still play a big role in their survival. For the Alert Sectors, some of the strict guidelines may be relaxed.

In the third phase, the pandemic is over, a viable vaccine for the disease has been developed, and the economy can fully reopen and return to the pre-COVID days. Although some may be maintained indefinitely, most health and safety guidelines may be relaxed.

3.3 Alert sectors

3.3.1 Office and factories

For Banks, the opportunity lies in updating their IT infrastructure and migrating most of their services to an online platform. Digital banking, robo-advisory, and adoption of other FinTech services are all possible solutions. This year, interoperability between banks and mobile financial services has been implemented and may be more integrated into the system. All these will simultaneously increase the accessibility of banking services and also reduce foot traffic in banks.

Table 3 Phased reopening of the economy

<p>Phase 1: This phase is characterized by an over-stretched healthcare sector and an out-of-control pandemic. The critically important sectors have to reopen, but under strict guidelines. Safer sectors are allowed to operate as usual, and few are incentivized to expand</p>	<p>Allow Sectors Business as usual, with standard health and safety guidelines to be followed</p>	<p>Alert Sectors Allowed to operate, but under strict guidelines</p>
	<p>Advance Sectors Business as usual, with standard health and safety guidelines to be followed; incentivized to expand and grow</p>	<p>Avoid Sectors Complete lockdown of some sectors (aviation, hotels). Other sectors may partially operate (restaurants, retail stores, etc.)</p>
	<p>Phase 2: This phase is characterized by a falling infection rate, and a pandemic that is starting to come under control, but not completed yet. Some of the restrictions from Phase 1 may be relaxed and some riskier sectors are allowed to reopen.</p>	<p>Allow Sectors Business as usual, with standard health and safety guidelines to be followed</p>
<p>Phase 3: This phase is characterized by some future date when the pandemic is over and the global economy has started to return to normal. Most restrictions under Phase 1 and Phase 2 may be relaxed, although some may be held in perpetuity.</p>	<p>Advance Sectors Business as usual, with standard health and safety guidelines to be followed</p>	<p>Avoid Sectors Partial opening of most sectors, but under strict guidelines</p>
	<p>Allow Sectors Business as usual, with standard health and safety guidelines to be followed</p>	<p>Alert Sectors Business as usual, with standard health and safety guidelines to be followed</p>

It is unlikely that all banking services can migrate online, at least not in the short run. Therefore, banks will have to physically reopen their branches in a limited capacity. It is important to COVID-proof the offices. Multiple studies have identified indoor interactions as vectors of super spreaders: the odds of transmission in a closed, indoor space are several orders of magnitude higher than in open-air environments. Out of 7,324 documented cases in China, only one outbreak had occurred outside [16]. In addition, the risk of infection indoors is almost 19-times higher than the risk of infection in an open-air environment [17]. There is also strong evidence that the spread of the disease may be linked to airflow: the presence of strong air currents from air-conditioning, as is the case in most offices, is linked with infection of people nearby [18]. Therefore, opening banks, and other offices, where people sit close to each other for hours, talking and coughing and sneezing, poses high risks. Steps that may be taken to mitigate these risks, such as Masks, should be mandatory at all times. Offices should

consider providing masks to employees since they need to be changed every few hours. Recent studies indicate that the virus rarely spreads through surfaces. Most of the spread is person-to-person [19]. This makes masks mandatory. Hong Kong, in this regard, is a good example [20]. The city of 7.5 million residents have suffered only four deaths due to COVID-19. Experts ascribe this low rate to the widespread and pre-existing practice of wearing masks outdoors in Hong Kong. Work from home and in shifts: If certain activities migrate online and tasks can be conducted from home, there is no need to fully open bank branches (and other offices). Whenever possible, work should be done from home. This will make the office a safer space and reduce the burden on public transportation—another high-risk service sector that has reopened. Other schemes such as two separate six-hour shifts each day may be implemented that will immediately reduce the number of people in an office at any given time by half. Follow a zigzag sitting arrangement so that workers do not have to sit side-by-side. It is also a good time to pull back on the open-office culture and reinstitutes cubicles. Employees should be encouraged to conference call even within the same room, especially if it is a large room, and close proximity to face-to-face interactions can be avoided. Implement mandatory temperature testing of all workers when they enter the workspace and intermittently throughout the workday. Anyone showing symptoms of COVID-19 should be sent home. Even if this provision is misused, a “better safe than sorry” approach has to be utilized. Office meetings can move entirely online, even if all the attendees are present in the office.

For the factories, there are similar, perhaps worse, risks. The threat of working indoors with a large number of people over an extended period of time is potentially higher in a factory than in an office. In addition, factories face an additional burden: the socio-economic profile of factory workers is poorer than office workers. Be it for financial concerns, existing health concerns, lack of access to services and facilities, lack of awareness, or general apathy towards imposed rules and regulations, the infection rate and death rate are both higher in the poorer segments of the population [21]. This means that there is an added responsibility on the administrators and factories that are reopening to ensure a safe and secure work environment for their workers.

3.3.2 Outside and on public transport

A small portion of the population has access to private transportation and the vast majority of the people in Bangladesh rely on public transport. The latter represents a critically vital service for the people and the economy. However, given that the risk of spread of coronavirus is higher indoors,

in cramped places, with strong air currents, public transport represents a very high-risk sector to reopen.

Theoretically, certain mitigation strategies may help, although there are limits to the practicality of implementing them on a large scale in Bangladesh. These include limiting the number of passengers so that social distancing can be maintained; zigzag sitting pattern; embarking and debarking on the rides in a more orderly and restrained manner than is usual; queue-control; ePayment systems; mandating masks to be worn by all passengers; etc. In addition, the strategies that may be explored like flexible timing: Mandating flexible timing from offices and factories that are opening will cut down on the rush-hour traffic. Different work hours for public and private sector offices, offices and factories from different sectors, or different work hours for different office blocks organized in a checker pattern are all possible solutions to these. Employees may be given additional reporting and departure times within an office or a factory. Dedicated bike lanes may reduce the burden on public transport. Despite Dhaka (or other cities in Bangladesh) not being a very bike-friendly city such as Copenhagen, Tokyo, or Vancouver, there are still many riders. Implementing bike lanes helps during this pandemic but sets a good precedence for the future and possibly drastically lowers the number of automobile-bike collisions. Subsidizing the bike industry and incentivizing people to buy more bicycles may be possible policy avenues to explore. Public transport should be designated quiet zones: Speaking creates aerosols, increasing the risks of spread of the virus and speaking loudly increases the risks of spread considerably [22]. Unnecessary small-talk, talking on the phone, laughing out loud, etc., inside a public transport should be strictly discouraged. Bring ticket prices back down to pre-COVID levels: public transportation has opened primarily to help the lower-income and middle-income groups. These groups of people have been economically hit hard by the three-month lockdown. Increased ticket prices will be yet another hardship to their already over-stretched resources. If not to help these people, it makes no sense to reopen such a high-risk sector.

It is not possible to strictly observe everyone while they are out and about in public spaces. Therefore, success in preventing the spread of the disease will depend largely on the people taking personal responsibility. That may prove to be challenging in Bangladesh. However, in the past, massive awareness-raising campaigns have proved successful. With greater penetration of means of mass communication in recent years and the existence of a fundamental awareness about the threats of COVID-19 among the populace, a focused and targeted campaign may bear some fruits.

3.4 Advance sectors

Necessity is driving the widespread adoption of both these sectors. However, concerted and strategic interventions from the authorities in these sections can play a big role in developing these sectors and Bangladesh's overall COVID-19 response.

The University Grant Commission's decision to allow universities to administer online classes and exams during the Summer 2020 semester is a step in the right direction. Various universities have seen immediate steps to develop dedicated education platforms and learning management systems (LMS). Instructors are being provided training to be ready for the upcoming semester. Students are being provided need-based financial assistance to upgrade their home facilities to be ready for the new semester.

However, the cost and reliability of internet connection remain a big issue. Slow-moving universities may lack the technical competence to develop online academic modules. Moreover, the financial assistance that (not all) universities are providing mostly extends to gaining access to a good quality internet connection, whereas many households are without personal computers or tablets. Lowering internet bandwidth costs, ensuring greater accountability of internet service providers, concessionary financing schemes for students (and working professionals) to purchase electronic devices, providing technical know-how and training facilities to universities struggling with migration to online learning are all strategies that ensure the growth of this sector and encourage a larger number of people to stay home. In Phase 1 and Phase 2, such strategies will very likely expedite the economy's progress towards Phase 3.

eCommerce has been gradually growing in Bangladesh for a decade now, with an uptick in the last five years. However, the issue of unreliability and fraudulent practices remains. Exclusive of a few large eCommerce entities, trust among the customers is low, which has prevented its widespread adoption, even during the pandemic period.

The technical infrastructure to make eCommerce available and viable is present in Bangladesh. The authorities can help with ensuring a speedy and reliable means of lodging complaints, dispute resolution, and redressal of grievances from customers. Moreover, eCommerce entails an additional layer of risk that is not present in Online Learning: any good purchased has to be safely bagged and then transmitted via a courier, who will be coming in contact with a large number of people every day. Even though recent studies indicate that surface-to-skin transmission of the disease is low, it is not zero, and therefore, strict compliance with health and safety standards from the couriers is paramount.

3.5 Avoid sectors

The avoid sectors should be the last to reopen due to their relatively less importance to the country's economy and high-risk index. Therefore, their full reopening should only happen once the spread of the virus is well under control. However, as we have discussed, incentivizing the eCommerce sector will help a large portion of the Avoid Sector partially operate during the lockdown and in the first two phases. Some sectors (Aviation) will eventually reopen before others (Malls). Therefore, the strategy for the Avoid Sectors has to be one of prudence, implemented on an *ad hoc* basis.

3.6 What next for Bangladesh

After the partial reopening from June 1, the government has enforced a new criterion for re-imposing lockdown on a ward-by-ward basis if the infection rate of the area exceeds 40 in 100,000 people. However, two major issues remain in the form of whether a fully enforceable lockdown of red zones is practically possible, even if there is the political will to see it happen. In addition, if people from different zones are freely inter-mingling until high rate of infection is detected, the virus will still be spread via people who travel in and out of the zones. If the lockdown is to prevent red-zone residents from infecting people from orange and green zones, what happens to the uninfected residents of the red zones? If a hard curfew is not imposed within the red zones, the 40-in-100,000 rate will quickly snowball to a much higher number.

Not surprisingly, the number of daily infections and daily deaths have continued to climb. The granular zonal-lockdown approach may yet prove to be inappropriate for Bangladesh because of its population density. Even though different wards and zones may exist as separate entities on paper, they operate as one uninterrupted continuum as far as urban life is concerned.

However, it is important to acknowledge that no country has yet devised a definitive roadmap to reopening the economy. Many countries that have found success in curbing the spread of the virus and have been able to reopen the economy have seen spikes in the number of new cases. China has had to re-quarantine certain communities; France and South Korea have had to re-close schools after opening them; Germany has seen a rise in new infections after partial reopening. In a nutshell, no reopening so far has gone perfectly smoothly. However, some have gone according to plan, in as much as the issues that came up were anticipated and contingency plans developed *ex-ante*. Bangladesh's reopening plan, therefore, does not need to be perfect. It

needs to be versatile and contingent upon various pre-identified concerns.

4 Conclusion

The economy plays the most critical role in any country's prosperity. COVID-19 imposed lockdown significantly impacted the country's economic stability worldwide. This study aims to identify vulnerable sectors to COVID-19 and identify effective strategies to minimize the threat of reopening those sectors for effective economic operations in Bangladesh. Expert interviews have been conducted through online platforms for their opinions on which sectors are critical to the reopening of the economy and which sectors may be the most susceptible to transmission risk. Based on the findings from expert opinions, a quadrant analysis has been applied to identify, allow, alert, avoid and advance sectors on the basis of their CI and TR scores. Pharmaceuticals and grocery have been identified as allowed sectors that are important for the economy but pose relatively less risk of spreading COVID-19. Hotels, Malls, and Restaurants have been marked as to avoid sectors due to their low priority and high risk of transmission of the disease. Based on the expert suggestions, a three-phased strategy has been proposed. In the first phase, alert, advanced, and allow sectors are recommended to operate where once the spread of the disease is under control, avoid sectors may be allowed to open. In the third stage, when the pandemic is over, and a viable vaccine for the disease has been developed, all sectors contributing to economic prosperity can fully reopen and return to the pre-COVID days. As countries worldwide try to devise the appropriate strategy for their reopening, mapping the sectors on a risk-importance space is a tool that is easy to understand. In addition, central and local governments can use it in a multitude of heterogeneous environments and can, therefore, inform a critical aspect of the overall reopening strategy of a country.

Acknowledgements The authors also like to express their gratitude to the experts of Dynamic Institution of Geospatial Observation Network—DIGON (<http://digonresearch.org/>), a research consultancy firm for proofreading and assistance to publish the manuscript. Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

References

- Amit, S., Barua, L., & Kafy, A. A. (2021). "A perception-based study to explore COVID-19 pandemic stress and its factors in Bangladesh." *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 15(4), 102129
- Lai, L., "Singapore's Covid-19 circuit breaker ends on June 1; economy to reopen in three phases," 2020. [Online]. Available: <https://www.straitstimes.com/singapore/singapores-covid-19-circuit-breaker-ends-on-june-1-economy-to-reopen-in-three-phases>. [Accessed 8 June 2020]
- Reuter, "Qatar to lift lockdown in four phases from June 15," 9 June 2020. [Online]. Available: <https://www.reuters.com/article/us-health-coronavirus-qatar-idUSKBN23F2KD>. [Accessed 16 July 2021]
- Mamun, S., & Shawon, A. A., "Bangladesh set to test zone-wise lockdown from Tuesday night," 9 June 2020. [Online]. Available: <https://www.dhakatribune.com/health/coronavirus/2020/06/09/bangladesh-set-to-test-zone-wise-lockdown-from-tuesday-night>. [Accessed 16 July 2021]
- Ringelstein, R. (2020). "Berliner Senat beschließt "Ampel" statt Obergrenze," 12 May [Online]. Available: <https://www.tagesspiegel.de/berlin/warnsystem-in-der-corona-pandemie-berliner-senat-beschliesst-ampel-statt-obergrenze/25822996.html>. [Accessed 16 July 2021]
- Asian Development Bank. (2010). *Bangladesh Bureau of Statistics, "The informal sector and informal employment in Bangladesh,"* Manila: Asian Development Bank
- Datasense, B. R. A. C., & Unnayan Shamannay, "COVID-19 and national budget 2020–2021: Rethinking strategy for bottom of the pyramid," 2020. [Online]. Available: <https://www.brac.net/latest-news/item/1282-special-schemes-recommended-for-poor-in-2020-21-budget>. [Accessed 2 June 2020]
- Senan, A. (2020). "Reopening the economy: The balance between public health and people's will," [Online]. Available: <https://tbsnews.net/thoughts/re-opening-economy-balance-between-public-health-and-peoples-will-109924>. [Accessed 23 July 2020]
- UNDESA (2020). "World Population Prospects, 2019," UNDESA,
- Kafy, A., Faisal, A., Khan, H., & Sheel, P. (2018). "Exploring The Association of Surface Water Body Change and Rapid Urbanization in Rajshahi City Corporation (RCC) Area Using RS and GIS," Chittagong,
- Jones, E., Young, A., Clevenger, K., Salimifard, P., Wu, E., Luna, M. L. ... Allen, J. (2020). "Healthy Schools: Risk Reduction Strategies for Reopening Schools," Harvard T.H. Chan School of Public Health, Boston,
- McCartney, G. (2020). "The impact of the coronavirus outbreak on Macao. From tourism lockdown to tourism recovery," *Current Issues in Tourism*,
- Favero, C. A., Ichino, A., & Rustichini, A., "Restarting the Economy While Saving Lives Under COVID-19," 2020. [Online]. Available: <https://doi.org/10.2139/ssrn.3580626>. [Accessed 20 July 2020]
- Amit, S., Barua, L., & Kafy, A. A. (2021). "Countering violent extremism using social media and preventing implementable strategies for Bangladesh," *Heliyon*, p.e07121,
- Bonardi, J. P., Bris, A., Brühlhart, M., Danthine, J. P., Fasel, N., Gabay, C. ... Thoenig, M., "How to lift the COVID-19 lockdown? Outline of a prudent strategy combining health and economic factors," 2020. [Online]. Available: https://e4s.center/wp-content/uploads/2020/05/E4S_lockdown_EN_v2.pdf. [Accessed 3 July 2020]
- Qian, H., Miao, T., LIU, L., Zheng, X., Luo, D., & Li, Y., "Indoor transmission of SARS-CoV-2," 2020. [Online]. Available: <https://www.medrxiv.org/content/https://doi.org/10.1101/2020.04.04.20053058v1>. [Accessed 21 May 2020]
- Nishiura, H., Oshitani, H., Kobayashi, T., Saito, T., Sunagawa, T., Matsui, T. ... Suzuki, M., "Closed environments facilitate secondary transmission of coronavirus disease 2019 (COVID-19)," June 2020. [Online]. Available: <https://www.medrxiv>.

- [org/content/https://doi.org/10.1101/2020.02.28.20029272v2](https://doi.org/10.1101/2020.02.28.20029272v2). [Accessed 3 June 2020]
18. Lu, J., Gu, J., Li, K., Xu, C., Su, W., Lai, Z. ... Yang, Z. (2020). "COVID-19 Outbreak Associated with Air Conditioning in Restaurant, Guangzhou, China, 2020,". *Emerging Infectious Diseases*, 26(7), 1628–1631
 19. Centers for Disease Control and Prevention, & "How, C. O. V. I. D. (2020). 19 Spreads," [Online]. Available: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-COVID-spreads.html>. [Accessed 27 June 2020]
 20. Ward, A. (2020). "How masks helped Hong Kong control the coronavirus," [Online]. Available: <https://www.vox.com/2020/5/18/21262273/coronavirus-hong-kong-masks-deaths-new-york>. [Accessed 6 June 2020]
 21. Ahmed, K. M., "Why people don't follow Covid-19 instructions," 2020. [Online]. Available: <https://tbsnews.net/thoughts/why-people-dont-follow-covid-19-instructions-85564>. [Accessed 29 May 2020]
 22. O'Sullivan, F. (2020). "In Japan and France, Riding Transit Looks Surprisingly Safe," [Online]. Available: <https://www.bloomberg.com/news/articles/2020-06-09/japan-and-france-find-public-transit-seems-safe>. [Accessed 14 June 2020]
 23. Killian, J. A., Charpignon, M., Wilder, B., Perrault, A., Tambe, M., & Majumder, M. S., "Evaluating COVID-19 Lockdown and Business-Sector-Specific Reopening Policies for Three US States," 2020. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3598744. [Accessed 24 July 2020]
 24. Song, B., & Hei, X., "Models and Strategies on Reopening Lockdown Societies due to COVID-19," 2020. [Online]. Available: <https://ideas.repec.org/p/osf/osfxxx/umtvh.html>. [Accessed 15 July 2020]
 25. Andersen, T. M., Schröder, P. J., & Svarer, M. (2020). "Designing Reopening Strategies in the Aftermath of COVID-19 Lockdowns: Some Principles with an Application to Denmark,". Bonn: IZA – Institute of Labor Economics
 26. Baqaee, D., Farhi, E., Mina, M. J., & Stock, J. H. (2020). "Reopening Scenarios," National Bureau of Economic Research, Massachusetts,
 27. Jang, H., Rempel, E., Carenini, G., & Janjua, N., "Exploratory Analysis of COVID-19 Related Tweets in North America to Inform Public Health Institutes," 2020. [Online]. Available: <https://arxiv.org/abs/2007.02452>. [Accessed 16 July 2020]
 28. Li, X., Zhou, M., Wu, J., Yuan, A., Wu, F., & Li, J., "Analyzing COVID-19 on Online Social Media: Trends, Sentiments and Emotions," 2020. [Online]. Available: arXiv:2005.14464. [Accessed 12 July 2020]
 29. Barkur, G., Vibha, & Kamath, G. B. (2020). "Sentiment analysis of nationwide lockdown due to COVID 19 outbreak: evidence from India," *Asian Journal of Psychiatry*, vol. 51,
 30. Samuel, J., Rahman, M. M., Nawaz Ali, G. G. M., Samuel, Y., & Pelaez, A., "Feeling Like It Is Time to Reopen Now? COVID-19 New Normal Scenarios Based on Reopening Sentiment Analytics," 2020. [Online]. Available: <https://www.preprints.org/manuscript/202005.0318/v1>. [Accessed 25 June 2020]
 31. Ahmed, M. E., Rabin, M. R. I., & Chowdhury, F. N., "COVID-19: Social Media Sentiment Analysis on Reopening," 2020. [Online]. Available: arXiv:2006.00804. [Accessed 3 July 2020]

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.