

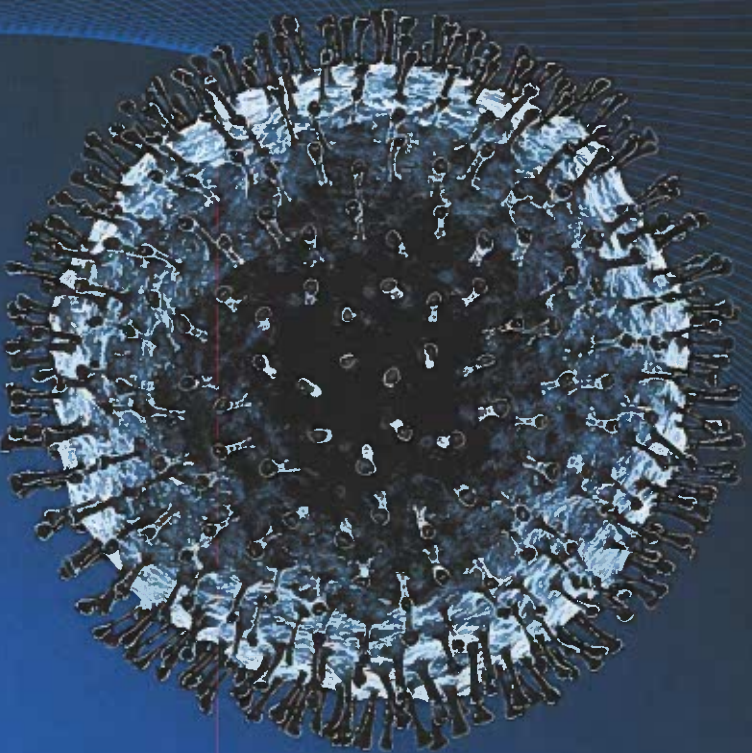
McKinsey
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Coronavirus COVID-19: Facts and Insights

Updated: March 5, 2020

Global Health + Crisis Response

**DOCUMENT INTENDED TO PROVIDE
INSIGHT AND BEST PRACTICES RATHER
THAN SPECIFIC CLIENT ADVICE**



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- **COVID-19 is, first and foremost, a humanitarian challenge.** COVID-19 has affected communities on multiple continents, with over 3,100 deaths out of over 93,000 reported cases. To date, Wuhan and Hubei province have been the most affected locations. Thousands of health professionals are heroically battling the virus, putting their own lives at risk. Overstretched health systems mean that Wuhan and Hubei will need time and help to return to a semblance of normalcy.
- **Solving the humanitarian challenge is the top priority.** Much remains to be done globally to respond and recover, from counting the humanitarian costs of the virus, to supporting the victims and families, to developing a vaccine.
- **This document is meant to help with a narrower goal: provide facts and insights on the current COVID-19 situation to help decision-makers understand best practices.** In addition to the humanitarian challenge, there are implications for the wider economy, businesses, and employment. This document sets out some of those challenges and how organizations can respond in order to protect their people and navigate through an uncertain situation.

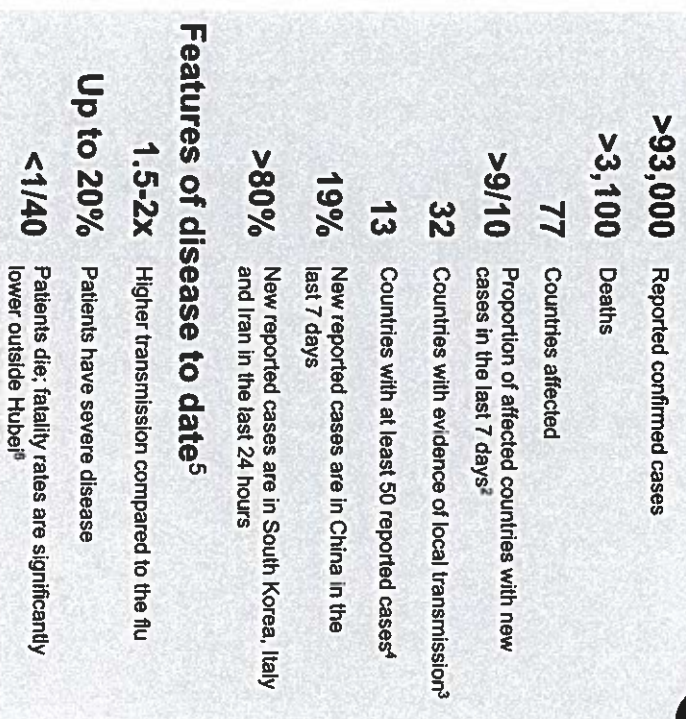
Executive summary (March 5, 2020)

- **COVID-19 continues to spread rapidly around the world.** Four transmission complexes (i.e., China, East Asia, Middle East, Europe) are active, with a fifth emerging in the US. Governments globally are preparing for the virus to hit their countries
- **Epidemiologist consensus suggests that the virus is highly transmissible and disproportionately impacts older segments of the population with underlying conditions.** The average patient infects 1.6 to 2.4 other people, and people older than 70 years experience 3–4 times the average fatality ratio from COVID-19
- **There are, however, two swing factors that remain unclear but could play a large role in how the virus evolves:**
 - **Extent of undetected, milder cases.** Those that are infected often display only mild or no symptoms, so it is easy for cases to be missed. Some studies suggest that there may be more instances of mild cases than are being detected, which means that the fatality ratio could be lower
 - **Whether the virus is subject to seasonality.** There is no evidence so far on whether COVID-19 will show seasonality (i.e., naturally reduce in the northern hemisphere as spring progresses). Coronaviruses in animals are not always seasonal but have historically been so in humans for reasons that are not fully understood. The behavior of this COVID-19 strain is, at this point, not entirely predictable
- **Given these considerations, there are three possible scenarios for COVID-19 and its economic impact:**
 - **Quick recovery scenario:** Confirmation of the fatality ratio and disease severity rate in the population of those of working age and below, combined with a limited duration of economic shutdown, and strong public health measures, lead to a drop in new case growth. While there is a reduction in consumer demand, it is localized and restricted to fewer than four weeks of disruption. Expected 2020 global GDP growth drops from 2.5% to –1.7-2.2%, mostly due to an acute drop in consumer demand in China, along with a moderate decline in Europe and the US
 - **Global slowdown scenario:** The fatality ratio does not fall below 1%. Countries find it difficult to replicate strong public health measures, contributing to continued case growth. Ultimately, the spread of the virus is slowed down by seasonality. The economy recovers in late Q2, but 2020 global GDP growth drops to –1.0-1.6%
 - **Global pandemic scenario:** There is a global, generalized spread of COVID-19, which is not impacted by seasonality. The economy experiences a demand shock that lasts for most of the year. Health systems might be overwhelmed in many countries that face large-scale human impact. Overall, the 2020 global GDP remains at near-zero levels (between -0.5 to +0.9%)
- **Given the rapid spread of COVID-19 to date, companies could consider the following actions:** Protect and provide purpose to employees, stress-test their financials, stabilize the supply chain, engage customers, and integrate all these efforts under a central Nerve Center

COVID-19 – Epidemiological information

Latest as of March 4, 2020

Impact to date¹

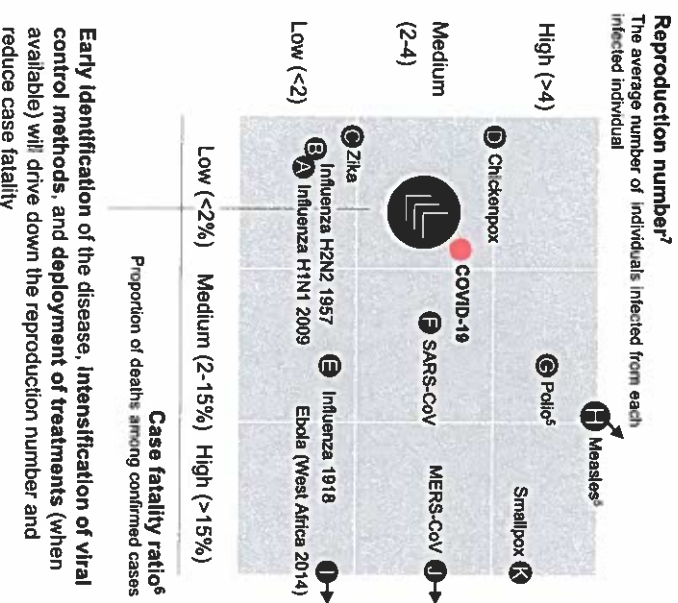


Features of disease to date⁵

- 1.5-2x** Higher transmission compared to the flu
- Up to 20%** Patients have severe disease
- <1/40** Patients die; fatality rates are significantly lower outside Hubei⁶



Comparison to other diseases



1. Latest numbers are available from a number of sources, including daily situation reports from the World Health Organization
 2. Excluding cruise ships, ~45 for US
 3. Previously noted as community transmission in McKinsey documents; now aligned with WHO definition
 4. >50 reported cases in China, South Korea, Japan, Singapore, Malaysia, Italy, France, Germany, Spain, UK, Iran, Kuwait (no local transmission) and US
 5. Evidence on exact numbers are emerging, however expected to decrease as viral containment measures intensify and treatments are developed
 6. Case fatality numbers are reflective of the outbreak setting and depend on a number of factors, including patient's age, community immunity, health system capabilities, etc.
 7. In outbreak setting or at the beginning of the introduction of a new disease

Source: World Health Organization, CDC, latest news

Global considerations

- Numbers of affected countries has risen significantly, with 39 new countries with cases in the last 7 days
- Number of countries with signs of local transmission³ is rising every day
- Reported cases in Iran significantly increased (by >50% in the last 24h), likely due to an increase in reporting and initial capacity constraints
- Ability to contain disease in the Iran- and US-centered complexes, and countries within transmission complexes, will be critical in the next week to limit propagation

China (outside Hubei)

- Daily incremental case count remains low for the last 7 days; fewer than 1 reported cases per million residents
- Overall downward trends in the number of confirmed cases reported

Four major transmission complexes exist, with a fifth emerging

A complex combines confirmed local transmission, >50 confirmed cases, tough-to-prevent people movement

Complex with mature/on-going propagation Complex with early propagation

5 complexes with COVID-19 propagation

Deep economic integration and regular human and material movements mean that it will be tough to limit virus propagation within these complexes

- >250 reported cases
- 100-249 reported cases
- <10 reported cases
- 50-99 reported cases
- Suspected local transmission



Transmission complexes

	Trend ¹	Total cases ⁵	Total deaths ⁵
1 China complex: Mature propagation		80,422	2,984
2 East Asia ² – South Korea centered complex: Ongoing propagation		5,890	41
3 Europe – Italy centered complex: Ongoing propagation		3,366	84
4 Middle East ³ – Iran centered complex: Ongoing propagation		2,544	77
5 Americas – USA ⁴ centered complex: Early propagation		155	6
6 Africa: Limited to no propagation ⁴		7	0

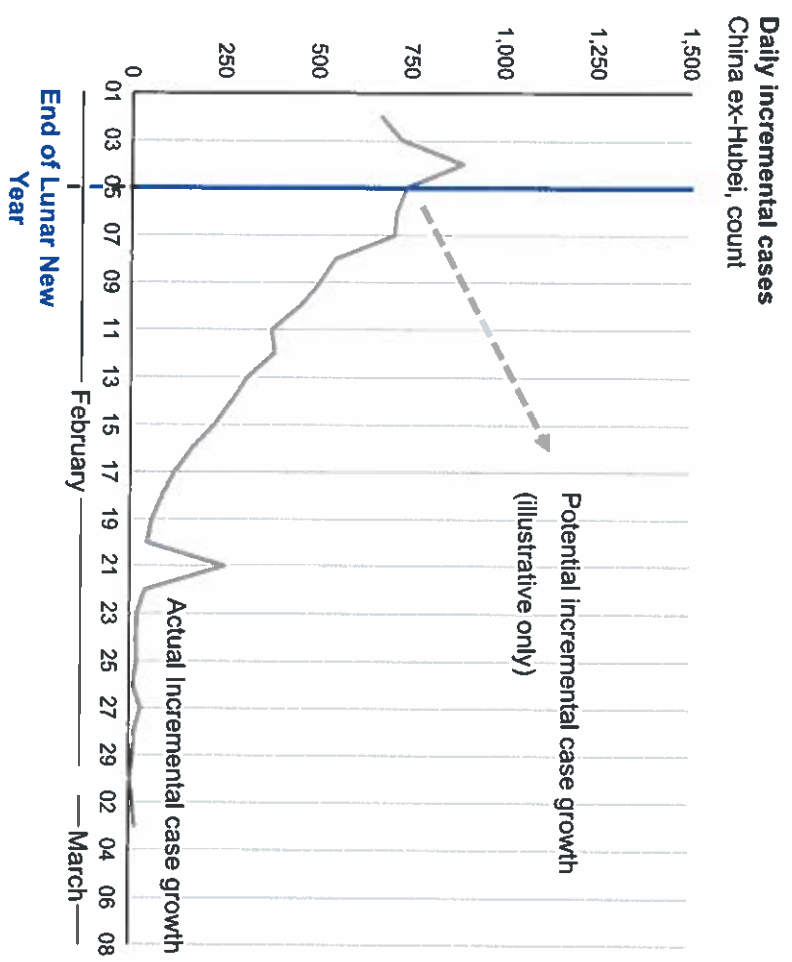
1. Indicating the trend in incremental reported cases per day | 2. Includes Western Pacific (excl China) and South-East Asia WHO regions | 3. Eastern-Mediterranean WHO region | 4. <5 cases in Algeria 5. Excludes Cruise Ship
6. USA has >100 reported cases - 64 confirmed by WHO (included right) and 45 cases among persons repatriated to the US among those from Diamond Princess Cruise ship reported by CDC (not included right)

Source: World Health Organization, team analysis

COVID-19 – China’s context and case count growth ex-Hubei

China context

- Population**
1.4 bn with 11% over 65 years old¹
- Population density**
~3.3X higher population density in China compared to upper middle income countries¹
- Respiratory Risk**
8.6% of adults have underlying respiratory issues (COPD)²
- 1.4X higher mortality rate** attributed to pollution compared to upper middle income countries¹
- Primary health system**
5.6% of the doctors in township health centers had formal medical education in 2010 compared to 10% in 2017³



¹. World Bank Data ². Koch et al, Characteristics and health burden of the undiagnosed population at risk of chronic obstructive pulmonary disease in China, PLoS Public Health (2019); Fang et al, Chronic obstructive pulmonary disease in China: a nationwide prevalence study, The Lancet Respiratory Medicine, 2018; 3. BMJ ³. BMJ
Source: World Health Organization, World Bank Development Indicators, BMJ, expert interviews

What we know:

- Transmissibility
- Impact on older patients with underlying conditions

What is being discovered:

- Extent of mild cases and implied case fatality ratio
- Seasonality
- Asymptomatic transmission

Unaddressed, COVID-19 can spread rapidly – yet public health measures have helped minimize spread

Migration post-Lunar New Year

Diamond Princess cruise ship

Overview

25 Jan

China marked the Lunar New Year while concerns grow about the coronavirus

~3,700

Number of crew members and guests on board of Diamond Princess cruise ship

~3bn

Original number of trips expected to occur during the Lunar New Year

1 Feb

Individual who had been a passenger tested positive for COVID-19 six days after leaving

10 individuals who had been on board tested positive for COVID-19; Japan's Ministry of Health places the entire ship under a 14-day quarantine

Response

- Extension of the Lunar New Year holiday
- 14-day self-quarantine of everyone travelling from affected areas
- Rapid expansion of hospital facilities
- Closure of tourist sites, cancellation of public events
- Travel restrictions imposed
- Japanese public servants tested passengers; those who tested positive were transported to health facilities
- Those who had symptoms stayed on board until cleared
- Some repatriated passengers who were placed under additional quarantine tested positive

Impact

754

Number of incremental cases February 1, China ex-Hubei

~700

Reported number of confirmed COVID-19 cases

376

Number of incremental cases February 11, China ex-Hubei

~50%

Percentage of confirmed cases where no symptoms were evident

6

Confirmed number of deaths due to COVID-19

Highly transmittable, especially in confined spaces

Few or no symptoms in many confirmed cases

Comprehensive public health measures effective in reducing case count growth post-Lunar New Year, minimizing viral spread despite high passenger volumes

Three scenarios for how COVID-19 could evolve

Potential scenarios as of March 5, 2020

Quick recovery

- More mild, undetected cases than currently assumed
- **Fatality ratio** approaches those of the flu (or an existing therapy proves effective)
- Socioeconomic reaction is **localized** versus disseminated
- Virus is **seasonal**

Global slowdown

- Number of mild, undetected cases exist, but is **not a major factor**
- Fatality ratio is found to be **five times greater** than that of the flu (or no existing therapy effective)
- Reaction is **generalized**
- Virus is **seasonal**

Global pandemic and recession

- Number of mild, undetected cases exist, but is **not a major factor**
- Fatality ratio is found to be **ten times greater** than that of the flu (no existing therapy proven effective)
- Reaction is **generalized**
- Virus is **not seasonal**

How the scenario could evolve

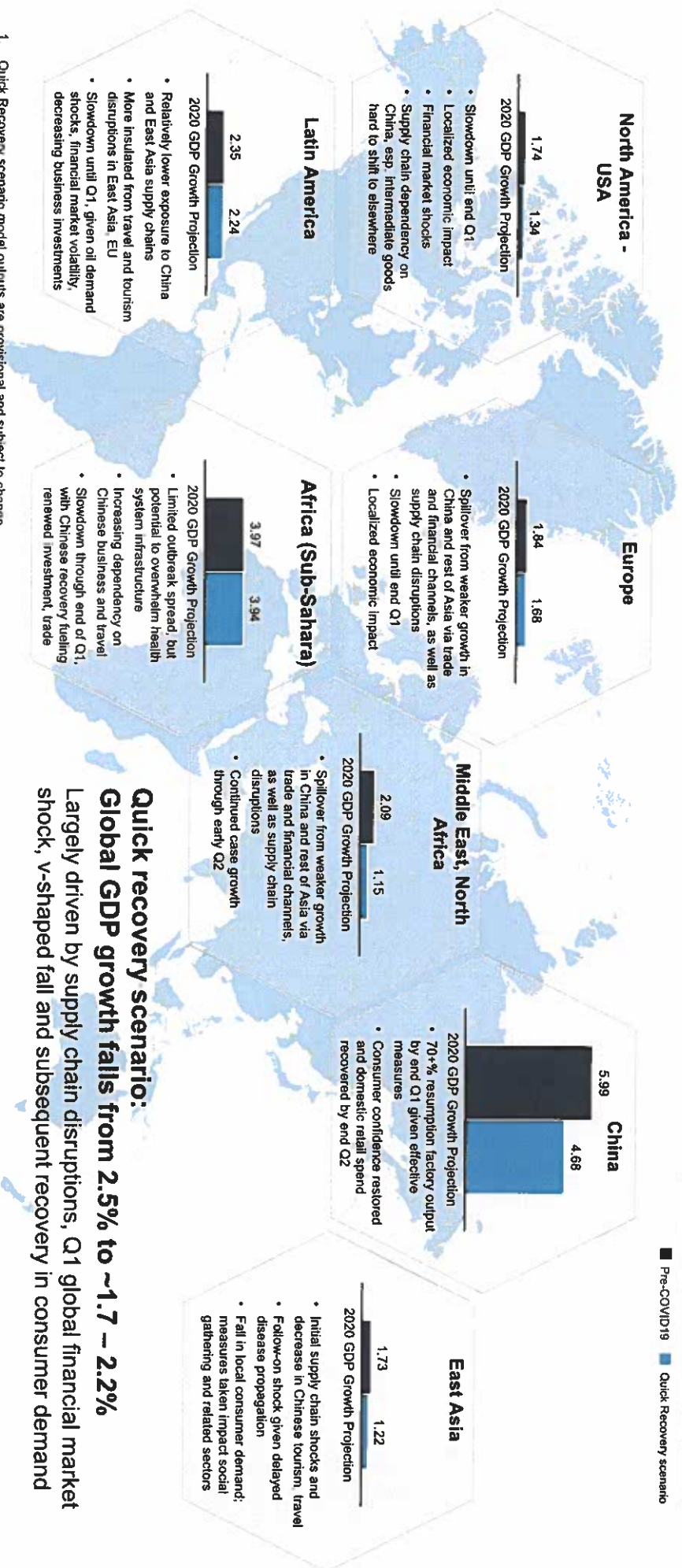
- **China recovery is largely complete**, including Hubei by early Q2
- Middle East, especially Iran, sees **continued case growth** through early Q2
- US, Europe economic **slowdown until the end of Q1**; observe localized economic impact
- Rest of Asia, Africa, LatAm see **little local transmission**

- **China recovery is largely complete**, including Hubei by early Q2
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- US, Europe economic **slowdown until mid-Q2**; observe generalized economic impact
- Rest of Asia, Africa, LatAm see **little local transmission**

- China recovery drives new transmissions; **complete by Q3**
- Middle East sees **continued case growth** through 2020
- US, Europe see **generalized transmission and generalized reaction**; economic slowdown until **end Q3**
- Rest of world sees **high transmission**

Potential impact of COVID-19 outbreak on 2020 GDP growth¹

Even in a “quick recovery” scenario, regions experience significant economic disruption



1. Quick Recovery scenario model outputs are provisional and subject to change

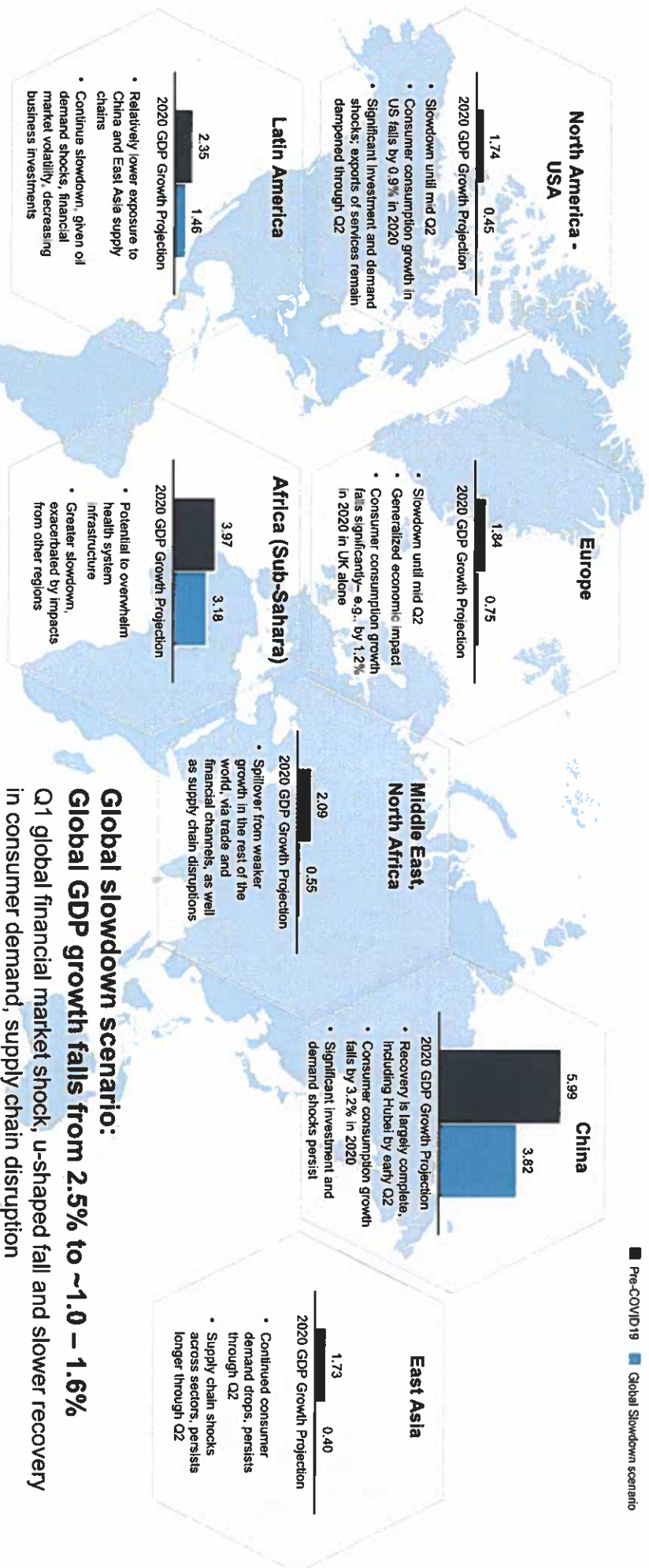
Source: World Health Organization, Oxford Economics, Industry reports, Press articles, team analysis

**Quick recovery scenario:
Global GDP growth falls from 2.5% to ~1.7 – 2.2%**

Largely driven by supply chain disruptions, Q1 global financial market shock, v-shaped fall and subsequent recovery in consumer demand

Potential impact of COVID-19 outbreak on 2020 GDP growth¹

In a “global slowdown” scenario, regions experience significant economic disruption and prolonged recovery

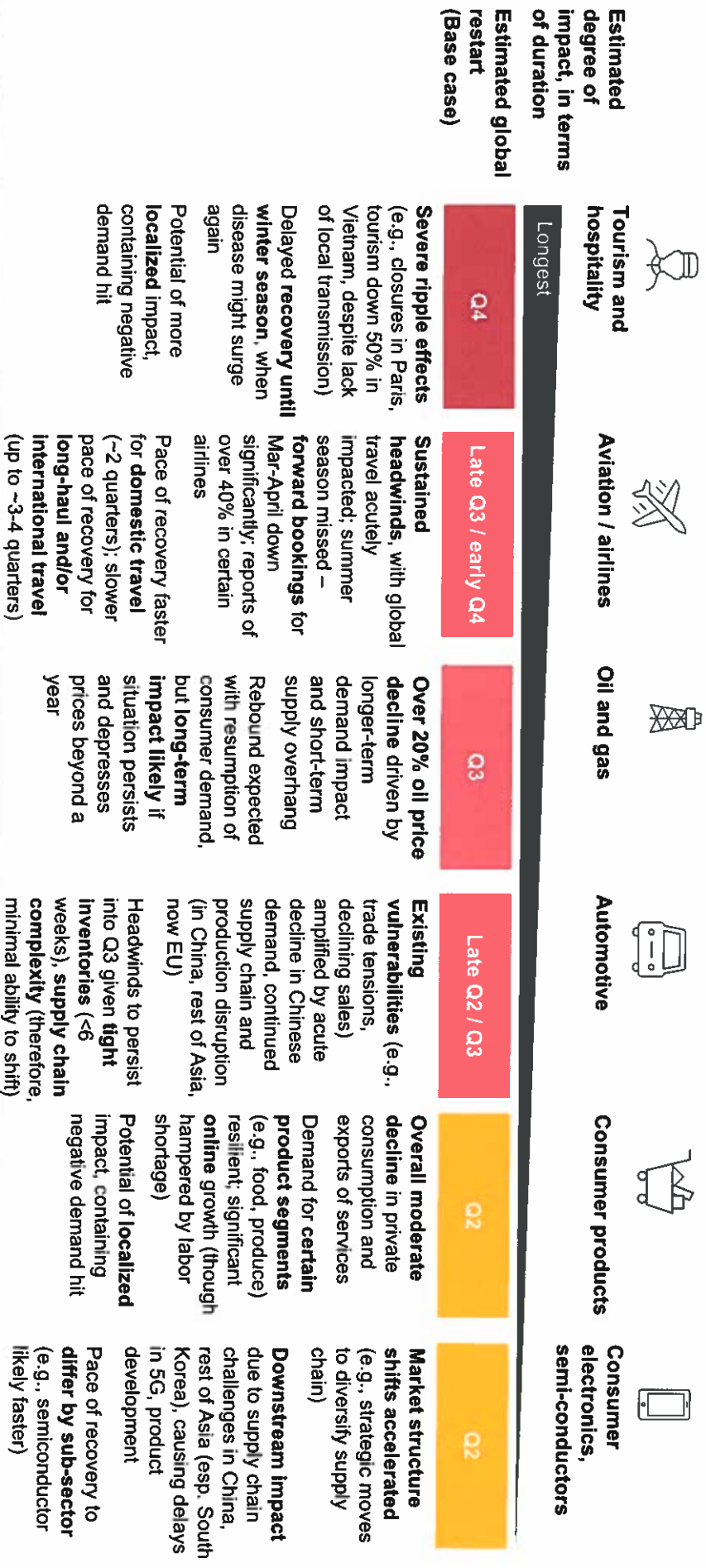


1. Global Slowdown scenario model outputs are provisional and subject to change.

Source: World Health Organization, Oxford Economics, Industry reports, Press articles, team analysis

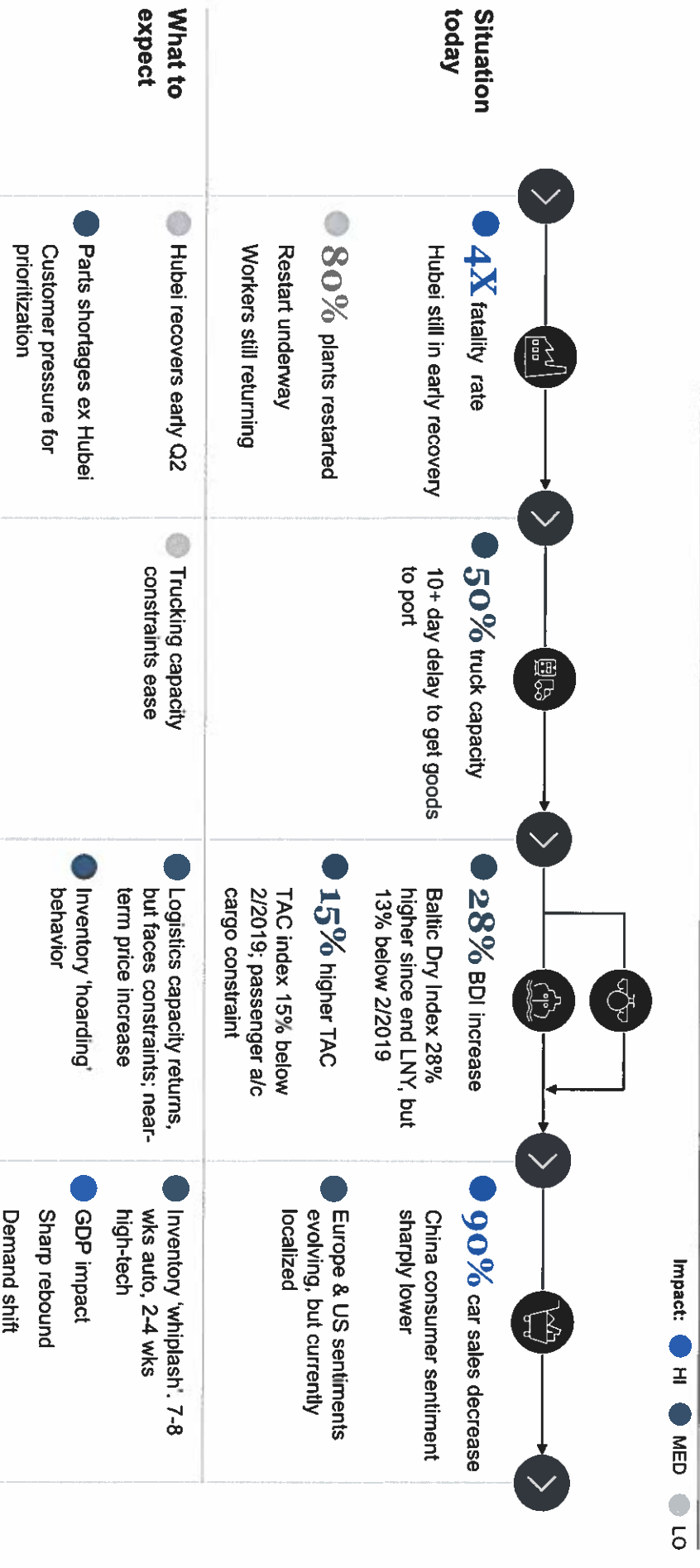
All sectors are impacted, with several seeing severe consequences

Preliminary views based on base case – Subject to change as the COVID-19 outbreak evolves



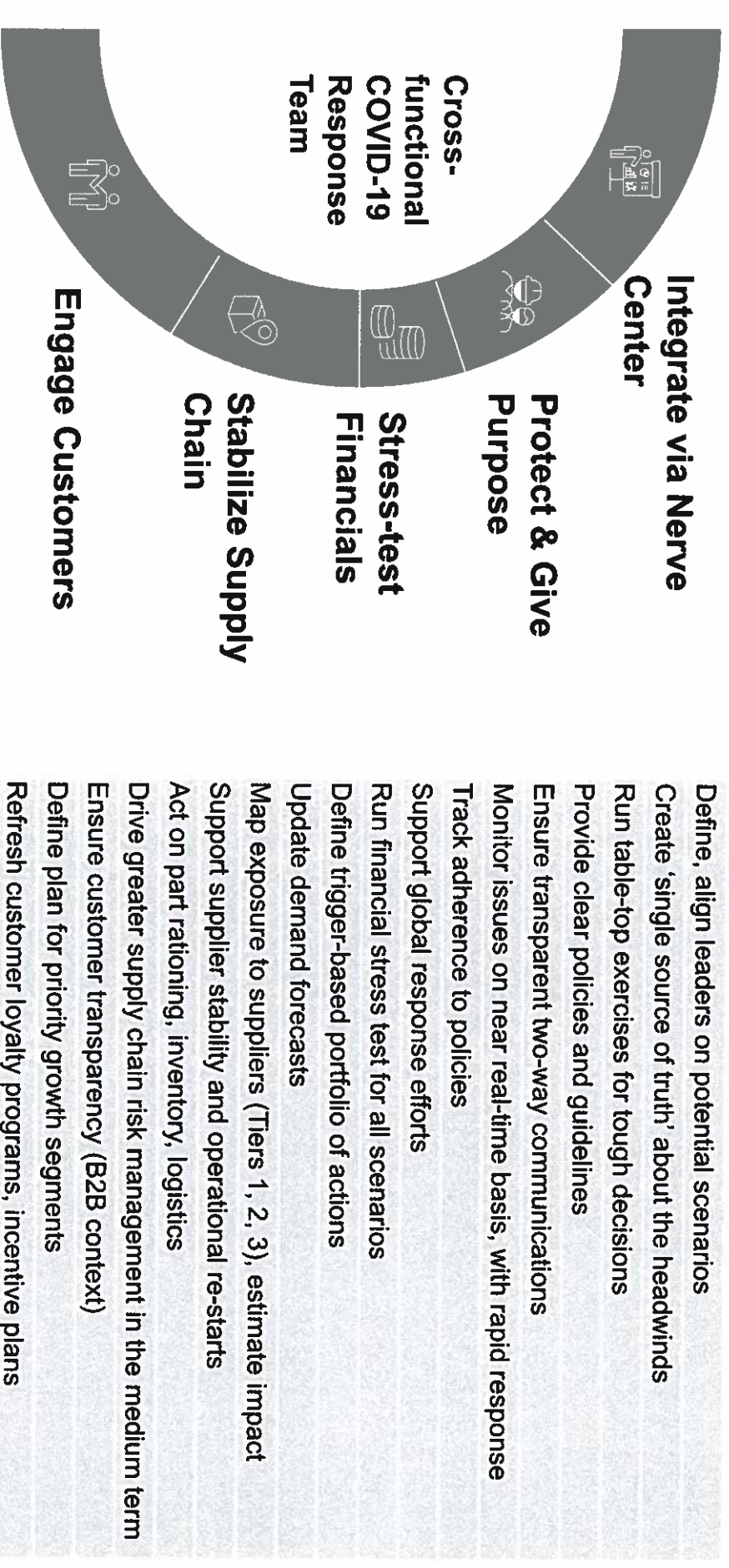
Source: IHS Market; McKinsey Global Institute Analysis; Subject matter experts; Press reports

Many disruptions exist across the supply chain, but the full impact has yet to be felt



Source: WHO Situation Reports; CDC travel notice; IATA; Reuters; TomTom traffic index; press searches; HSBC Business School; Tencent News; Sina news; Beijing Environmental Protection Monitoring Center; Shenzhen Environment Network

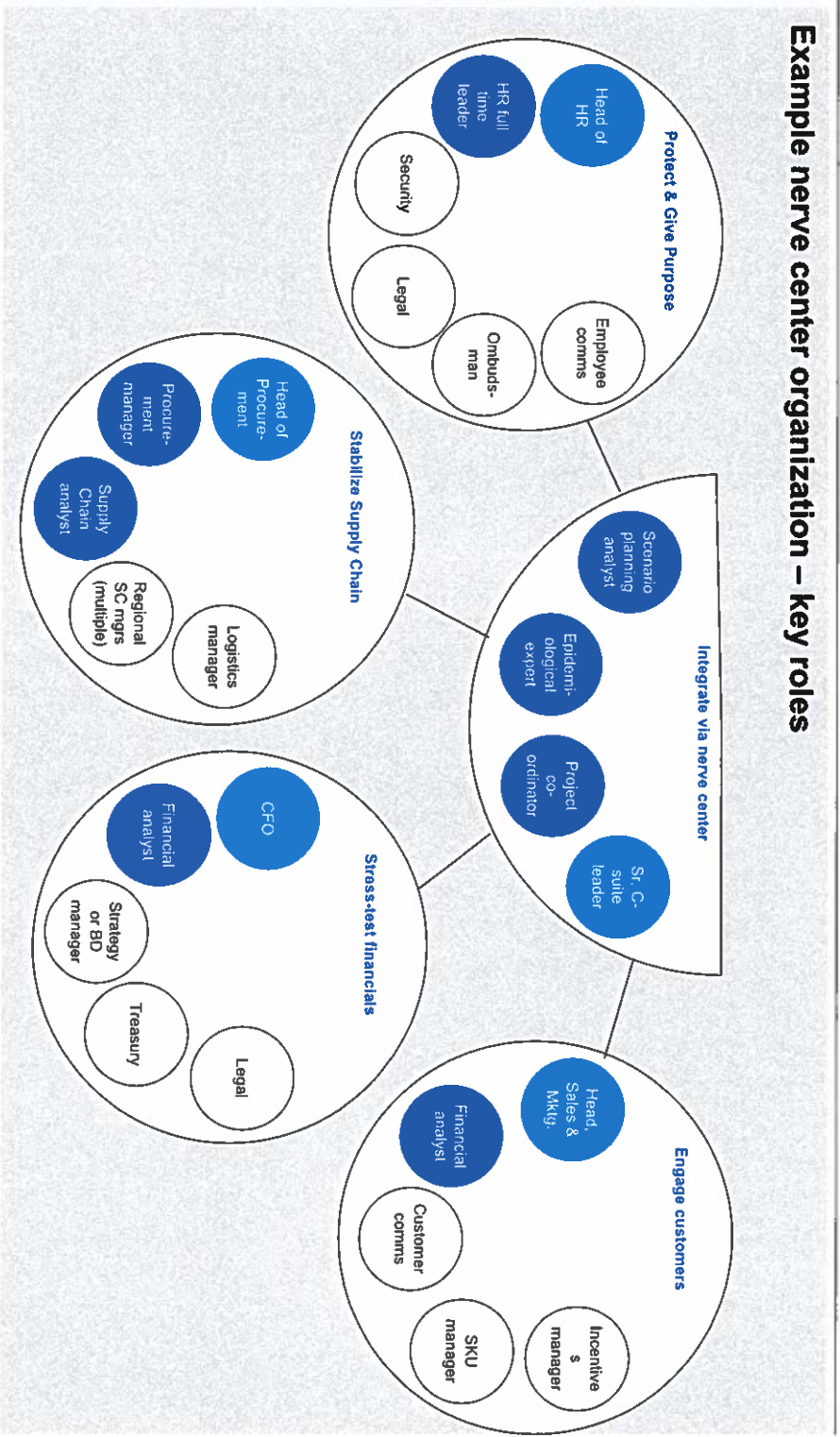
COVID-19 Response Workstreams



Cross-functional COVID-19 Response Team

Example COVID-19 Response Nerve Center organization

Example nerve center organization – key roles



- **Multiple semi-autonomous, cross-functional teams working in parallel (helps speed)**
- **Agile principles, enabled by clearly articulated values**
- **Simple meeting cadence and radical transparency across groups (e.g., all working materials available to all)**

Example COVID-19 Response Nerve Center organization

	Industry agnostic measures	Non-manufacturing or direct service industries specific measures	Manufacturers-specific measures
Travel restrictions	<ul style="list-style-type: none"> Delaying all non-essential travel to highly affected areas (e.g., China, Italy, Japan) Cancelling big gatherings and events 		
Ways of working	<ul style="list-style-type: none"> Splitting critical workforce in different locations or different parts of the building/workspace Devolving manager accountability so employees could put their health first and take decision accordingly Quarantining employees who recently visited highly affected areas (e.g., China, Italy, Japan) Quarantining employees exposed to confirmed cases (e.g., working on the same floor) 	<ul style="list-style-type: none"> Offering employees the flexibility to work from home 	<ul style="list-style-type: none"> Changing shifts to allow for parents to be at home with kids (i.e., in areas with school closures) Introducing virtual shifts so certain roles (e.g., monitoring) are minimized Staggering shifts Temporarily closing production sites in highly affected areas (e.g., Northern Italy)
Health precautions	<ul style="list-style-type: none"> Over-communicating policies around safety/precaution in a simple readable format Sanitizing workplaces on a more frequent basis Sending care packages to employees (e.g., a thermometer, hand sanitizer and vitamin C) Monitoring temperature of all employees at the entrance to the building 	<ul style="list-style-type: none"> Reducing the range of products 	
Other	<ul style="list-style-type: none"> Encouraging open communication to ensure employees can speak up if they feel unsafe Revising policies to ensure no punitive measures taking for "days off" due to being ill 	<ul style="list-style-type: none"> Quarantining cohorts in advance of shifts 	<ul style="list-style-type: none"> Leveraging parcel shipping technology to reallocate its inventory to mitigate the impact of the virus Dividing production facilities (e.g., sealing out certain areas, making handovers without physical contact, protecting groups of people from each other)

Source: Team analysis, press search

Example supply chain actions to consider

Immediate (2-4 weeks)

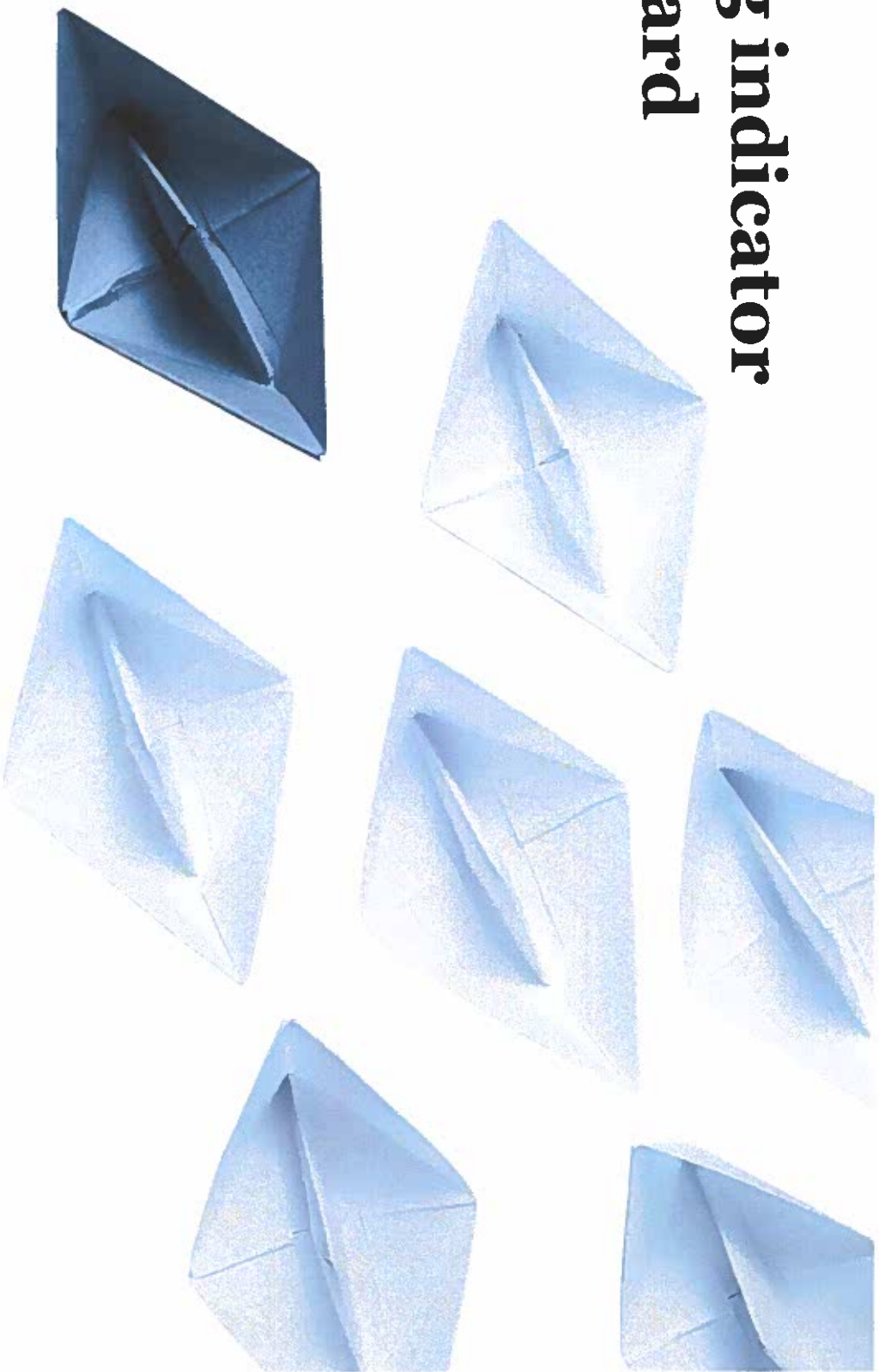
Understand exposure	<ol style="list-style-type: none"> 1. Determine truly critical components and understand risks of tier 1 to tier 2 suppliers onwards 2. Define current inventory buffer and locations¹ 3. Identify origin of supply (i.e., Hubei/ Wuhan) to identify severity of risk 4. Conduct scenario planning to understand financial and operational implications in prolonged shutdown (scenarios 2 and 3) 5. Work with S&OP to get 3-6 month accurate demand signal segmenting likely to be impacted demand to determine required supply
Take action to address anticipated shortages	<ol style="list-style-type: none"> 6. Look to ramp up now on alternative sources if supplies are in Hubei and accelerate exploration of additional options 7. Change mode of transportation to reduce replenishment lead-time and pre-book air freight² / rail capacity as required by current exposure 8. Optimize limited production determining highest margin and highest opportunity cost / penalty production 9. Collaborate with all parties to jointly leverage freight capacity, new/alternate supply sources, etc. 10. Watch for extending lead times to gauge performance and capacity against supplier promises 11. Use after sales stock as bridge to keep production running
Ensure resources required to restart	<ol style="list-style-type: none"> 12. Work with supplier to source personal protective equipment for production lines operating in affected markets (e.g., glasses, gloves and masks) 13. Engage with crisis communication teams to clearly communicate to employees on infection risk concerns (e.g., disseminate facts about virus from credible source) and work from home options 14. Consider short-term stabilization for suppliers (e.g., low-interest loan) to allow for a faster restart
Understand additional options	<ol style="list-style-type: none"> 15. Determine what portion of supply can be swung to another site if shutdown persists based on sourcing strategy (single, dual, multi) 16. Identify ways to expedite qualification process and/or insource 17. Determine possible geographies and supplier shortlists in case alternate supply is required

1. Buffer stock from Lunar New Year may provide a cushion and potential false sense of security. Impact likely to be felt first in JIT supply chains (e.g., automotive).
 2. Given costs, airfreight might not be an option for many industries; availability is already limited

Mid-term (2-4 months)

Continuously improve material supply stability	<p>Evaluating alternative sourcing options for all the materials impacted – availability of suppliers, additional cost due to logistics, tariffs, estimate of price increase of the components</p> <p>Enhance the demand verification process to correct inflated demand to mitigate the bullwhip effect</p> <p>Provide continuous support the mid-small size tier 2-3 suppliers in financial troubles</p> <p>Assess regional risks for current and backup suppliers</p>
Kick off designing resilient supply chain for the future	<p>Establish a supply chain risk function</p> <p>Digitalize process and tools to integrate demand, supply, and capacity planning</p> <p>Trigger the new supply network design for resilience</p> <p>Codify the processes and tools created during the crisis management as formal documentation</p> <p>Convert war room into a reliable risk management process</p>
Build collaborative relationship w/ external partners	<p>Work with government to explore potential tax benefits</p> <p>Actively engage investors and other stakeholders to build transparency on the situation and get help</p>

Leading indicator dashboard



COVID-19 Leading Indicator Dashboard

Propagation of COVID-19 across new transmission complexes

Epidemiological Indicators				Compound daily growth in cases				
Cluster	Repression-lative country	Date of initial case	Total number of cases	Number of new cases in last 14 days	Last 3 days	Prior 3 days	Case fatality ratio ²	Peak case count observed ³
South-Asia (ex-China)s	South Korea	Prior to 01/20	4,812	4,781	15%	36%	0.6%	N
	Japan	Prior to 01/20	268	203	5%	11%	2.2%	N
	Singapore	01/24	108	31	3%	3%	0%	N
Europe	Rest of region	Prior to 01/20	136	39	5%	3%	2.2%	N
	Italy	01/31	2,036	2,033	32%	40%	2.6%	N
	France	01/25	191	179	50%	68%	1.6%	N
Middle East ⁴	Germany	01/28	157	141	40%	47%	0%	N
	Rest of region	01/29	349	325	37%	50%	0%	N
	Iran	02/20	1,501	1,501	57%	60%	4.4%	N
Americas	Rest of region	02/15	190	189	23%	27%	0%	N
	US	01/23	105	82	1%	5%	3.1%	N
	Rest of region	01/27	41	33	34%	19%	0%	N

Source: WHO Situation Reports; CDC travel notice; IATA; Reuters; TomTom traffic index; press searches

Economic/policy indicators			
# of countries/territories restricting travel	# of airlines service to impacted country ⁴	Traffic congestion levels ⁵	Data N/A
39	☹☹☹☹☹	Data N/A	
17	☹☹☹☹	38	63
15	☹☹☹	37	60
29	☹☹☹☹☹	34	69
2	☹☹	61	71
2	☹☹	53	59
30	☹☹☹☹☹☹☹☹☹☹	Data N/A	
3	☹☹☹	69	69

VERSION 2 - CURRENT AS OF MARCH 5, 2020

Current phase

- Stage 1: Small number of cases identified; no sustained local transmission
- Stage 2: Disease spread and sustained local transmission
- Stage 3: Government action/shutdown in public behavior; Not all affected regions enter stage 3, but significant gov. intervention/ economic impact signal prolonged recovery
- Stage 4: Case growth/stretched health systems
- Stage 5: New case drop, activity resumption

CDC travel health notice

- Warning Level 3
- Alert Level 2
- None

Traffic congestion level⁵

- 03/04/2020
- 03/04/2019

- Based on WHO definition, previous version used community transmission and local transmission interchangeably.
- Case Fatality Rate calculated as (deaths on day X) / (cases on day X). Note that previous versions of this dashboard (February 28 and prior updates) calculated CFR = (deaths on day X) / (cases on day X-7) to account for disease incubation period. We changed the definition because the old formula was causing confusion for some readers.
- Assessment based on observed stoppage in growth of cases and medical community's opinion validated by external sources.
- Anecdotal reports of airline suspensions based on press searches.
- Based on representative cities: Tokyo, Singapore, Milan, Paris, Berlin, Los Angeles, India, Western Pacific (excl. China) and South-East Asia WHO regions.
- Eastern Mediterranean WHO region.
- Note: All countries or regions have documented 3rd generation cases.

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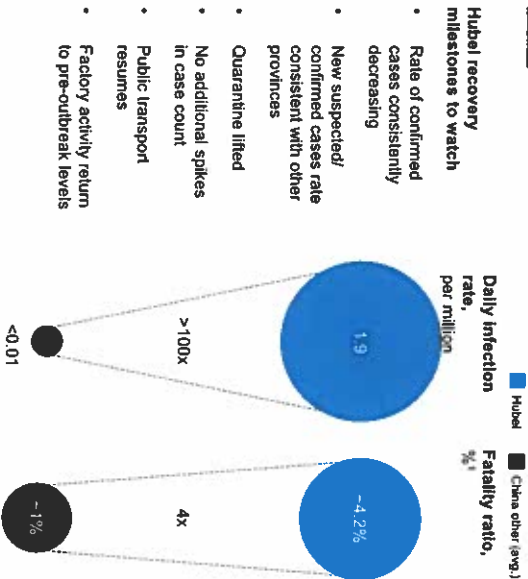
COVID-19 Leading Indicator Dashboard – China-specific

Currently tracking towards restart in China

Hubel impact

How deeply is Hubel (esp. Wuhan) impacted, and when could economic activity restart?

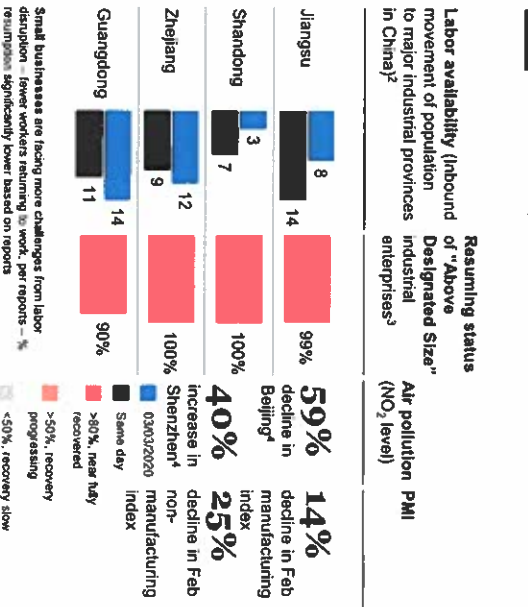
Late Q2
 Hubel remains deeply impacted
 Return to economic activity tough to foresee until mid Q2



CN economic restart

How quickly could economic activity restart in China (ex-Hubei)?

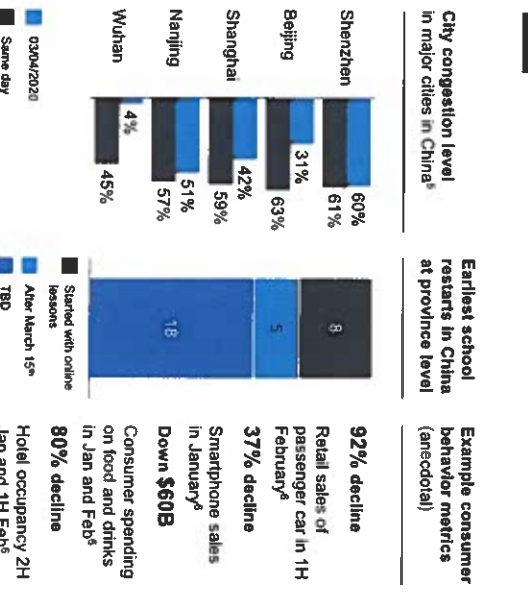
Late Q1
 Restart (ex-Hubei) has begun, but faces challenges – from worker shortage to movement of goods with larger companies witnessing higher business resumption rate
 Most activity likely to return late Q1



CN consumer confidence

How quickly will Chinese consumer confidence and purchasing activity return?

Early Q2
 In-China consumer spend may lag a few weeks behind economic restart
 Certain sectors (e.g., tourism) impacted well into Q2



1. Case Fatality Rate calculated as deaths on day X1 / cases on day X1. Note that previous versions of this dashboard published CFR = deaths on day X1 / cases on day X-7 to account for disease incubation period. We changed the definition because the old formula was causing confusion for some readers. 2. Measures condition: 6. Year over year comparison. Source: WHO Situation Reports; National Bureau of Statistics of China; McKinsey Global Institute; OECD Data; Johns Hopkins CSSE press research; TomTom traffic data; Baidu Qianxi; CDC; New York Times; Reuters; csg.com; The Economist; Tsinghua University