



**Asia-Pacific  
Economic Cooperation**

**Advancing** Free Trade  
for Asia-Pacific **Prosperity**

# **Value Chain Resilience in the Asia Pacific: A Synthesis Report**

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**APEC Policy Support Unit**  
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The views expressed in this paper are those of the authors and do not necessarily represent those of APEC Member Economies.

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# 1. BACKGROUND

Global Value Chains play a dominant role in global trade and business. The increase in global trade has been attributed to the increased activity of GVCs, with multinational corporations (MNCs) contributing around 80% of global exports (World Economic Forum 2013a). Growth in GVCs also encourages FDI, to some extent.

The World Investment Report noted that global production of MNCs continues its steady growth as seen from the employment, sales and exports figures from the foreign affiliates of MNCs. It seems that companies are working well under the GVC scheme and have been able to prosper and to expand.

**Table 1 Selected key performance indicators, foreign affiliates of TNCs, 2013**

<b>2013 Level</b>	<b>Change over 2012</b>
71 million of employees	+5%
\$35 trillion of sales	+9%
\$7 trillion of value added (~10% of global GDP)	+6%
\$97 trillion of managed assets	+8%
\$8 trillion of exports	+3%

Source: Presentation about World Investment Report 2014 by Masataka Fujita.

Originally, GVCs are more commonly seen in the production of electronics and transportation goods. But with the increase in offshoring and outsourcing activities, GVC business models can now be found in clothing, footwear, travel goods, sporting goods, and services.

With increased fragmentation and complexity in global production and trade, firms' exposure to risks has also increased substantially. What used to be defined as local risks could now be easily transmitted through the GVCs network, creating, unfortunately, additional exposures and layers of risks. Thus, the 'toxic' and 'contagious' nature of risks are now being considered seriously by global investors.

While firms have been dealing with risks that threaten to disrupt their operation and have established management strategies to mitigate those risks, the nature of global value chains with extensive and complex cross-border operations have created new challenges. These challenges include coordination and synchronization issues between different (lead) firms and suppliers with differences in technology, information system, SOP, human resources and culture, among others.

Based on a World Economic Forum (WEF) Supply Chain and Transport Risk Survey conducted in 2011, the following triggers were seen as the most likely to cause global supply chain disruptions (Table 2).<sup>1</sup>

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<sup>1</sup> In the survey, respondents ranked external disruptions based on the likelihood of these disruptions to provoke significant and systemic effects on supply chain or transport networks. Disruptions are grouped according to four categories: environmental, geopolitical, economic, and technological.

**Table 2 Triggers of global supply chain disruptions**

Environmental	Economic
Natural disasters (59%) Extreme weather (30%) Pandemic (11%)	Sudden demand shocks (44%) Extreme volatility in commodity prices (30%) Border delays (26%) Currency fluctuations (26%) Global energy shortages (19%) Ownership/investment restrictions (17%) Shortage of labour (17%)
Geopolitical	Technological
Conflict and political unrest (46%) Export/import restrictions (33%) Terrorism (32%) Corruption (17%) Illicit trade and organized crime (15%) Maritime piracy (9%) Nuclear/biological/chemical weapon (6%)	Information and communications disruptions (30%) Transport infrastructure failures (6%)

Source: Figure 2, WEF (2012).

The Asia Pacific Economic Cooperation Policy Support Unit (APEC PSU), in consultation with the Committee of Trade and Investment (CTI), conducted four studies to deepen understanding and increase awareness of the emerging systemic risks and value chain resilience (VCR) by evaluating three elements of resilience—value chain risks, strength and connectedness—quantitatively and estimating their impact on the APEC region’s trade and investment.

This synthesis report attempts to summarize the main findings of those studies as well as the policy implications and the way forward.

## 2. MAIN FINDINGS

### PHASE 1: QUANTITATIVE ANALYSIS ON VALUE CHAIN RISKS IN THE APEC REGION

#### Definition

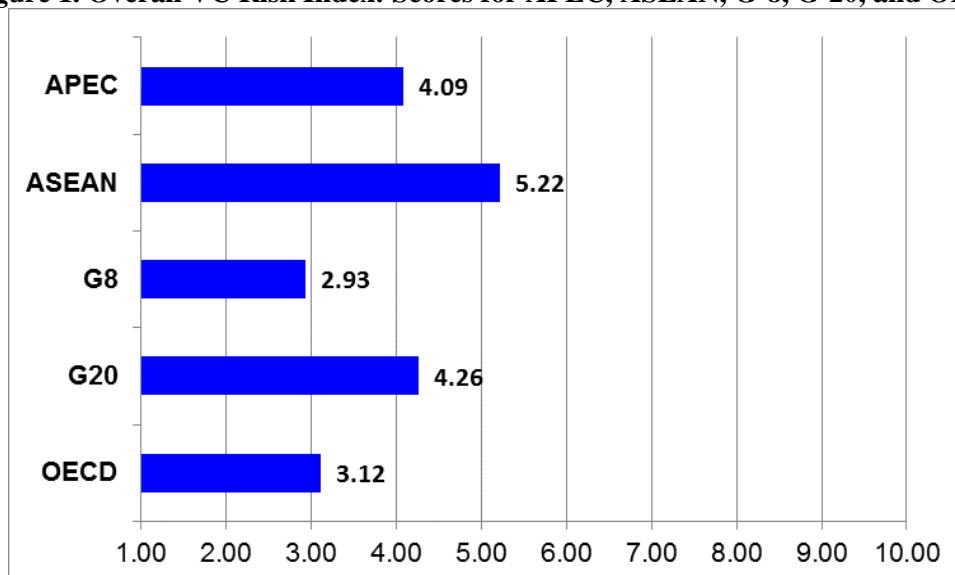
The starting analysis of Value Chain Resilience begins with the identification of Value Chain (VC) Risks. VC Risks “include all factors that add to the transactional uncertainty associated with value chain processes”. Phase 1 identifies five category of risks that are being considered most relevant to firms under the global value chain network:

1. *Natural Disaster Risks*: the possibility that economic activity may be impeded by natural disaster. For example, natural disasters such as floods, storms and earthquakes pose a serious threat to firms and supply chain activities.
2. *Logistics and Infrastructure Risks*: the set of disruptions that can occur to supply chain processes when the markets or actors that connect supply chain operators to each other do not perform as expected. For example, disruptions in the logistics processes such as infrastructure failure may result in delays and/or damage of shipments.
3. *Market Risks*: economic fluctuations that disrupt prices, output, or other economic fundamentals. For example, events such as the global financial crisis could disturb supply chain financing and investment flows.
4. *Regulatory and Policy Risks*: unexpected changes in regulatory stance, or inconsistency in enforcement, that can increase business uncertainty, and thus the transaction costs associated with value chain processes. For example, legal uncertainty and corruption could limit investment expansion or even in extreme cases cause firm to halt operation.
5. *Political Risks*: the possibility that economic activity may be impeded by the occurrence of political or violent conflicts inside or outside the economy. For example, fear of violent conflicts and terrorism could significantly affect employees’ performance in performing their duties and causes high cost of transactions.

#### Key findings

Results show that VC Risk levels are, on average, low to moderate in the APEC region. APEC’s performance is typically stronger than that of ASEAN, and is sometimes stronger than that of the G-20. Usually, the developed economy groups of the G-8 and the OECD perform more strongly than APEC. APEC’s strong performance could be attributed to the heterogeneity of the Asia-Pacific region in terms of development status and income level.

**Figure 1. Overall VC Risk Index: Scores for APEC, ASEAN, G-8, G-20, and OECD**

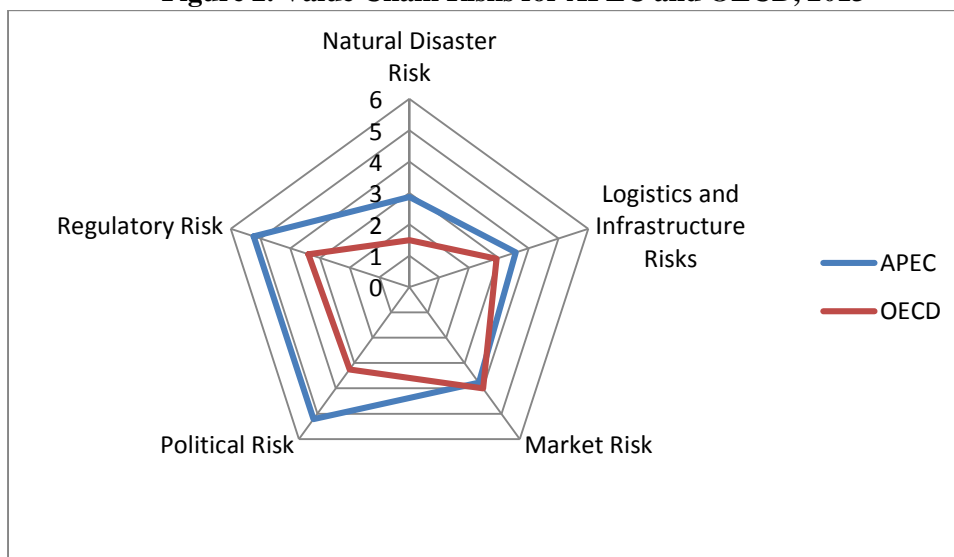


Note: The value chain risk index scores each economy from 1 (no risk) to 10 (maximum risk).

Source: APEC PSU (2014a).

The results also show significant room for improvement. For instance, G-8 and the OECD display significantly lower risks in several categories. Figure 2 below shows that, if we use OECD as a benchmark, APEC still has considerable room for improvement under natural disaster, regulatory and political risk.

**Figure 2. Value Chain Risks for APEC and OECD, 2013**



Note: The value chain risk index scores each economy from 1 (no risk) to 10 (maximum risk).

Source: APEC PSU (2014a).

The five categories of risks include the kind of risks that are directly actionable by governments such as regulatory and political risks; other kinds of risks like the threat from natural disasters will be rather difficult to prevent - governments and business will need to put in place adequate measures for preparedness and recovery. This will be discussed further in the next section.



## PHASE 2: QUANTITATIVE ANALYSIS OF VALUE CHAIN STRENGTH IN THE APEC REGION

### Definition

The Phase 2 report defines strength as the inverse of risk, which is the ability to respond to the occurrence of a risk or shock and limit its economic and social consequences, allowing a quick recovery of business and value chain activity. Value chain strength could be grouped into the following categories:

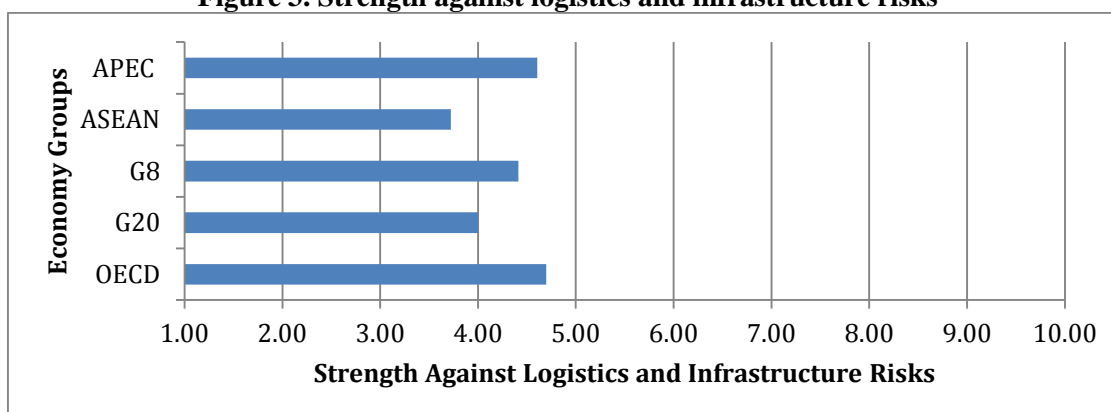
1. *Strength Against Natural Disaster Risks*: actions or policies that limit the economic and social consequences of the occurrence of a natural disaster. For example, factors such as the quality of health systems and the quality and availability of electricity and communications infrastructure will affect the capability of an economy to withstand and respond to disasters.
2. *Strength Against Logistics and Infrastructure Risks*: actions or policies that limit the economic and social disruptions that can occur to supply chain processes when the markets or actors that connect supply chain operators to each other do not perform as expected. For example, better logistics services and transportation infrastructure will enable firms to develop alternative routes whenever there is a disruption in the supply chain.
3. *Strength Against Market Risks*: actions or policies that limit the economic and social effects of economic fluctuations that disrupt prices, output, or other economic fundamentals. For example, while firms may have adopted their internal risk strategy to anticipate market fluctuations, governments could promote economic stability and reduce vulnerability through their monetary and fiscal policies.
4. *Strength Against Regulatory and Policy Risks*: actions or policies that limit the economic and social effects of unexpected changes in regulatory stance, or inconsistency in enforcement. For example, ensuring the rule of law through the judiciary system, including fair protection of investors by the legal system, will reduce the space for regulatory capture or arbitrary enforcement, protecting the value of investments made within the respective supply chain. Another example would be where good auditing and accounting standards could help to create more certainty and transparency for investors.
5. *Strength Against Political Risks*: actions or policies that limit the economic and social effects of the possibility that economic activity may be impeded by the occurrence of political or violent conflicts inside or outside the economy. For example, the capacity of civil and military forces to maintain and protect public safety is key in responding to and resolving conflicts.

The concept of risk and strength within value chain resilience are closely related. For example, economies which have experienced natural disasters such as earthquakes will usually build their cities with more stringent standards that could withstand some if not most damaging threats and impacts from earthquakes. As such, strong preventive and recovery measures could end up lowering a risk profile of an economy.

## Key findings

APEC scores are relatively high in each of the Value Chain Strength categories. Comparatively, APEC's performance is impressive in the following categories: (a) Strength Against Logistics and Infrastructure Risks; and (b) Strength Against Market Risks (Figure 3 and 4). APEC's overall index score in these categories is higher than the scores of the G-20 and ASEAN, and comparable with the OECD and G-8 developed economy groups. Developed APEC economies have the highest performance (5.8 out of 10) relatively with other regional groupings based on the available data. Developing member APEC economies' score of 5.1 is also higher than that of the G-20 and ASEAN.

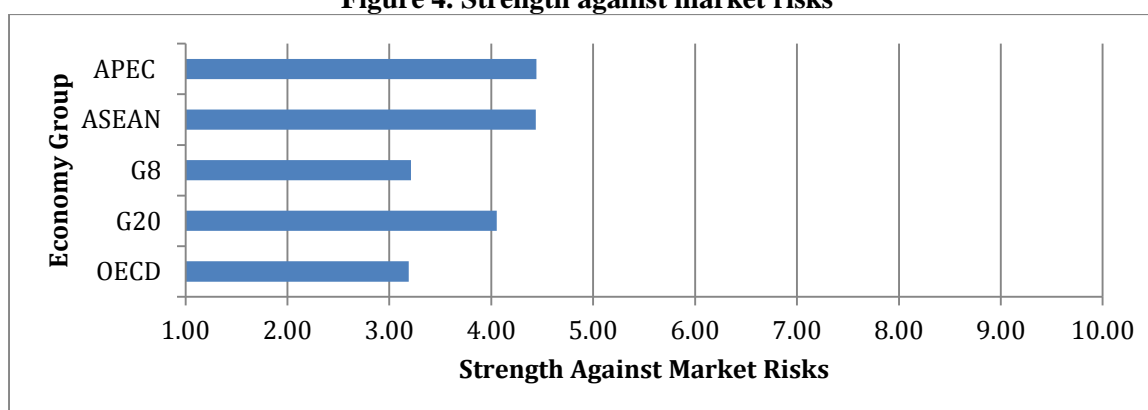
**Figure 3. Strength against logistics and infrastructure risks**



Note: The value chain strength index scores each economy from 1 to 10 (best) in terms of actions and policies that can mitigate risks or alleviate the impacts of negative shocks.

Source: APEC PSU (2014b).

**Figure 4. Strength against market risks**



Note: The value chain strength index scores each economy from 1 to 10 (best) in terms of actions and policies that can mitigate risks or alleviate the impacts of negative shocks.

Source: APEC PSU (2014b).

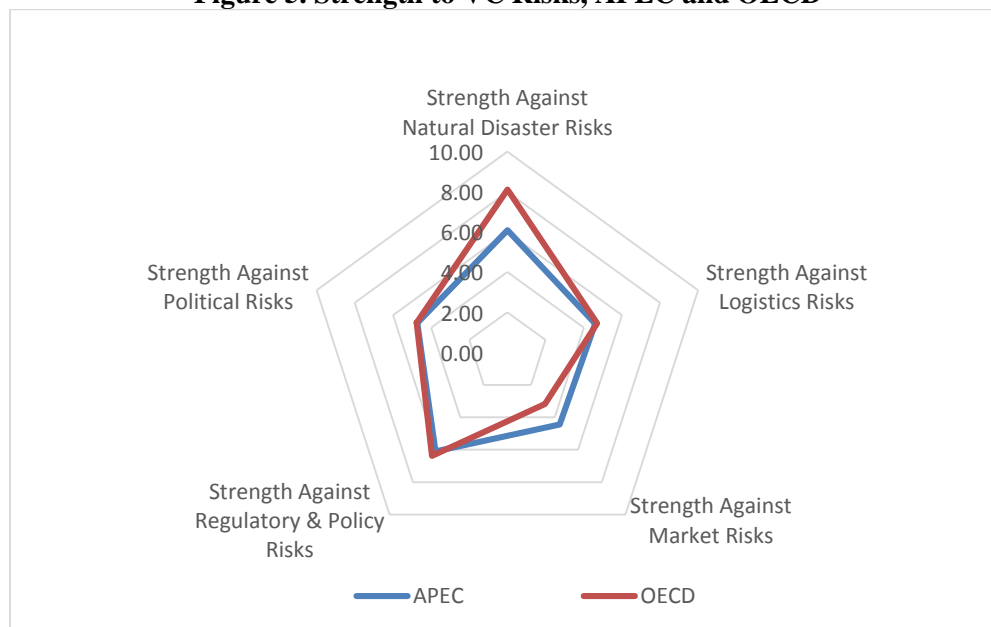
The case study section of the report, which analyses the private sector's strategies in coping with negative shocks, also points to the robustness of value chains in the Asia-Pacific with quick recovery to pre-crisis levels. This indicates that firms and their value chains are strong and have the ability to cope with the risks they are facing. The three case studies in the report highlighted the following factors affecting the resilience of the value chain to a shock (page 20-21):

- *Type of governance of the value chain:* by transferring specific resources (financial, human capital and information or knowledge) among partners, firms could improve resilience.
- *Sector and specificity of the products or services traded:* supply chains with products that are “modular” or standardized have more flexibility and options to respond to risks as changing suppliers is relatively easier.
- *Type of lead firms:* global buyers shift production faster than global manufacturers.
- *Regulatory environment:* higher level of integration among economies will prevent a protectionist responses to crises.

The case study in the report also highlights certain types of adjustment mechanisms that firms have applied in responding to shocks. These adjustments could take the form of market adjustments, stock adjustments, or alternative production.

The analysis on Value Chain Risks (Phase 1 of the project) highlighted that APEC economies overall faced a moderate level of risks and that some of those risks are external to the control of government. Based on the VC Strength index scores, APEC’s performance is robust by world standards and this has provided a favorable business environment for the operation of value chains. Nevertheless, continuous public and private efforts to improve and maintain performance are still necessary. For instance, APEC scores are still relatively lower compared to OECD under the category of strength against natural disaster and market risks (Figure 5).

**Figure 5. Strength to VC Risks, APEC and OECD**



Note: The value chain strength index scores each economy from 1 to 10 (best) in terms of actions and policies that can mitigate risks or alleviate the impacts of negative shocks.

Source: APEC PSU (2014b).

### **PHASE 3: EVALUATION OF VALUE CHAIN CONNECTEDNESS IN THE APEC REGION**

#### **Definition**

The indices from the previous two analyses—Value Chain (VC) Risk and VC Strength—show that despite having risk scores in the mid-level, APEC has considerable strength to recover whenever negative shocks hit. This has lent support to the operations of value chains in the Asia Pacific region.

Phase 3 of APEC’s project on Value Chain Resilience attempts to examine the existing network of value chains among economies. In the report, value chain connectedness is seen as a complex network of business activities. Connectedness highlights the systemic nature of Value Chain Resilience: the globalized nature of value chains implies that local risks and disruptions could now be transmitted along the chains. As such, firms will need to be prepared accordingly as a supply chain is only as strong as the weakest link.

Connectedness in the report is measured as the importance of an economy in the network, as shown by trade flows among economies. The connectedness of each economy is a weighted average of the connectedness of all other economies to which it is connected by value-added export flow. The weights in the average are export shares, namely the proportion of each economy’s total exports that go to each other economy.

#### **Key findings**

Using trade data in gross value terms<sup>2</sup>, Figure 6 below shows the global trade network among economies. While the network is complex, one interpretation is that the Asia-Pacific region is quite central to the global trade network. A number of Asia-Pacific economies are represented by large circles, which means that they are very strongly connected in terms of the global network and could be considered as ‘hubs’. Europe also shows similar strong trade connections in the figure<sup>3</sup>.

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<sup>2</sup> The data coverage includes 57 economies, including an aggregate rest of the world, ROW.

<sup>3</sup> Please note that the distance between economies in the figure is not related to geographical distance, but “instead captures “neighborhoods” of closely linked economies, and contrasts them with groups of economies with which they are less well-linked” (APEC PSU: 9, 2014c).

**Figure 6. Graphical Representation of the World Trade Network in Gross Value Terms, 2009**



Source: APEC PSU (2014c).

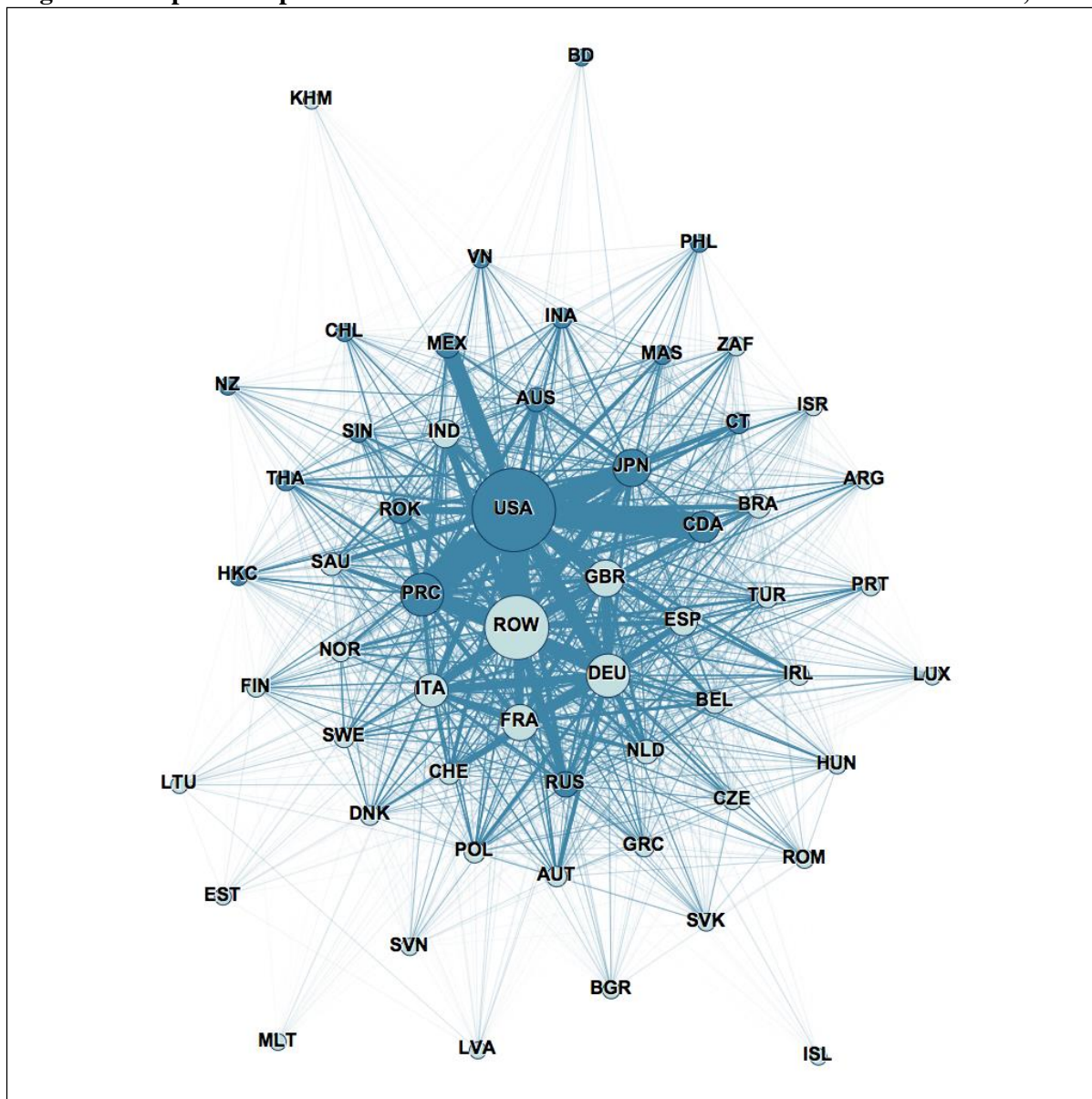
Strongly connected economies like the United States are connected to many APEC economies and also to other non-APEC economies, in particular Britain. The USA is Britain's most important trading partner in products such as industrial machinery, fuels, pharmaceuticals and chemicals (ING 2012). China shows a strong linkage to APEC but also to the rest of the world, such as Spain. While Spain is not China's main trading partner, from Spain's point of view trade with China's is very important (ING 2012).

The Phase 3 report further noted that "...the Asia-Pacific functions partly as a bridge between regions of the world: it is relatively central in the network, and well connected to most other parts of the world... Europe, by contrast, forms more of a self-contained unit, with strong links within the region, and strong links between some key economies and other regions, but many economies that exist primarily within a European space." (APEC-PSU 2014c: 18-19)

The world trade network in value added terms shows a similar pattern, in general. One of the differences is that "the dispersion of Connectedness scores is slightly lower in the case of

gross trade than in the case of value added trade... which suggests that the value added trade networks displays even stronger hub-and-spoke characteristics than the gross trade network: some economies are very well connected to the rest of the world, but others are relatively isolated"<sup>4</sup>. (APEC-PSU 2014: 20)

**Figure 7. Graphical Representation of the World Trade Network in Value Added Terms, 2009**



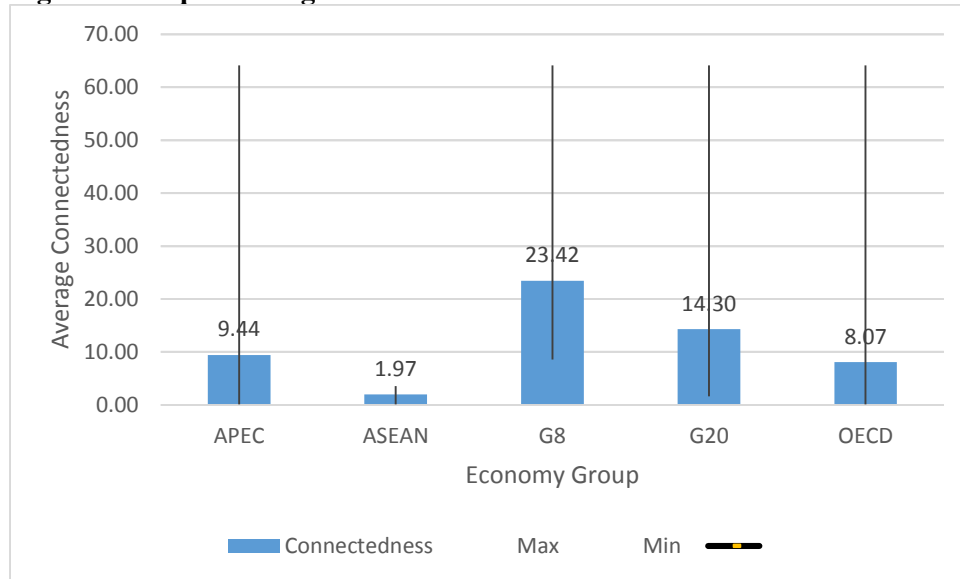
Source: APEC PSU (2014c).

Comparing 2009 with 1995 data shows examples of how an economy has successfully doubled its Connectedness score between 1995 and 2009 while another has increased its Connectedness score by about 50%. These increases could occur because of a strong growth in exports, significant liberalization at- and behind-the-border, and also through the implementation of a free trade agreement.

<sup>4</sup> This is also shows some degree of polarization among economies which is also similar with the pattern showed in the global maritime or air transport industry.

Based on the Connectedness scores for total trade in value added (Figure 8), APEC is quite a strong performer: APEC’s average score is about one-third higher than the world average; also higher than ASEAN and OECD. The G20 performs more strongly, supported by the high scores from the European economies.

**Figure 8. Simple Average Connectedness Score for Total Value Added Trade**



Note: The connectedness scores for each economy ranges from 0 to 100 (best).  
Source: APEC PSU (2014c)

APEC’s score is indeed highly heterogeneous, with some very prominent ‘hubs’ but also some of less well-connected economies. The report further noted:

“Indeed, the difference in Connectedness scores between developed and developing APEC economies is striking. For total value added trade, the average for the developed economies is 21.26, which is very close to the average score for the G8. The developed APEC economies are therefore some of the best connected economies in the world. By contrast, the average score for the developing APEC economies is 5.78, which is still substantially higher than the ASEAN average, but lower than that of all other groups.”

The above findings show the hub-and-spoke nature of GVCs in APEC. The results could also be a reflection of the location of many MNCs headquarters in the developed economies as well as the concentrated location of higher value-added activities such as product design and research and development.

The Phase 3 report found the following factors as being correlated with connectedness:

- a. Income level: Developed economies tend to have better Connectedness scores as they have more opportunity and propensity to trade with more partners. This could also explain the apparent association between economic size and Connectedness, as economic size is also a function of average income.
- b. Value Chain Risk and Value Chain Strength: Connectedness is higher when risk is lower, and it is higher when strength is higher. The reason in both cases is that firms want to minimize risk, and therefore choose to build strong trade and

investment links with the most resilient economies where it is easiest and most reliable to do business.

- c. **Key policy drivers:** policies that improve trade facilitation, logistics performance, transport connectivity and rule of law affect an economy's ability to connect to value chains.

#### **PHASE 4: ENHANCED RESILIENCY OF CROSS-BORDER VALUE CHAINS: IMPACT EVALUATION FOR THE ASIA-PACIFIC**

##### **Definition**

In this phase, the main objective is to explore the global economic impact of the three components of Value Chain (VC) Resilience: VC Risk, VC Strength, and VC Connectedness. To understand the economic impact, a global Computable General Equilibrium (CGE) model is used to perform counterfactual simulations based on various scenarios of VCR (Value Chain Resilience) improvement and analyze their impact on trade costs and other economic indicators. Outputs from the CGE model include economic indicators such as GDP, exports, imports, investment, and wages.

##### **Key findings**

The econometric analysis applied in the report shows that:

- a 5% decrease in the VC Risk index is associated with a 1.5% decrease in trade costs;
- a 5% increase in the VC Strength index is associated with a 2.7% decrease in trade costs;
- a 5% increase in the VC Connectedness index is associated with a 1.4% decrease in trade costs;
- the above figures suggest that a 5% improvement in VCR<sup>5</sup>, i.e. a decrease of that magnitude in VC Risk combined with increases of that magnitude in the other two variables, is associated with a 5.6% decrease in trade costs. As such, the relationship between VCR and trade costs is a bit higher than a 1:1 ratio.<sup>6</sup>

Following the econometric analysis, the global CGE model in the report performed four counterfactual simulations based on the following scenarios (APEC PSU 2014: 5):

- I. All APEC economies decrease Value Chain (VC) Risk and increase VC Strength and Connectedness by 5%. Non-APEC economies do not change. Improvements take place on a most favored nation basis, i.e. they benefit all economies with which the improving economies trade (*concerted unilateral reform*).
- II. All APEC economies decrease VC Risk and increase VC Strength and Connectedness by 5%, but the benefit only accrues to other APEC economies. Non-APEC economies do not change (*preferential regional reform*).
- III. All developed APEC economies decrease VC Risk and increase VC Strength and Connectedness by 5%, while developing APEC economies improve in each case by 10%

<sup>5</sup> This assumes all three variables as uncorrelated.

<sup>6</sup> It is reasonable to posit that the three aspects of VCR all have an impact on bilateral trade costs: a lower level of Risk makes it less costly to engage in VC trade, thereby promoting exports, while higher levels of Strength and Connectedness also reduce trade costs with the same effect.



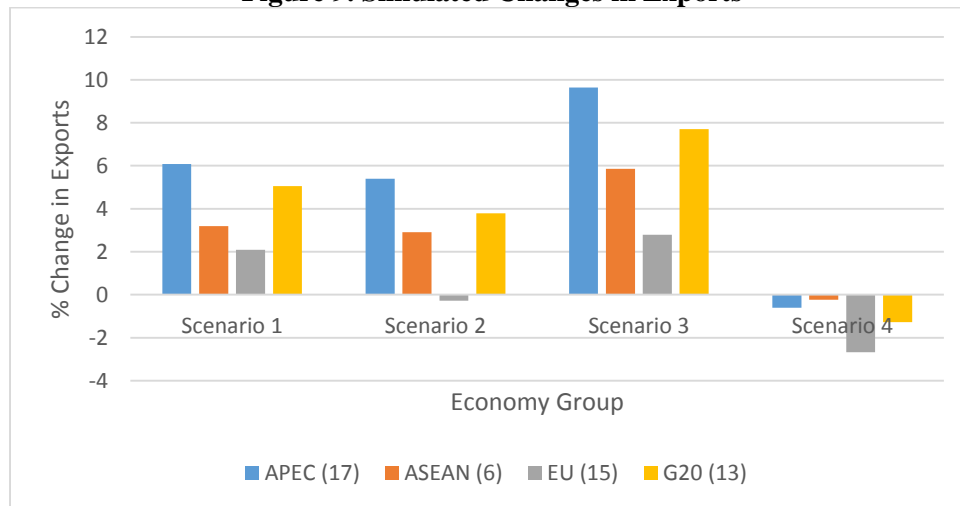
(potential of “catch up” by developing APEC economies). Non-APEC economies do not change. Improvements take place on a most favored nation basis, i.e. they benefit all economies with which the improving economies trade.

- IV. EU economies increase their VC Risk index and decrease their VC Strength and Connectedness indices by 5%. Deteriorations take place on a most favored nation basis, i.e. they affect all economies with which those economies trade (*a negative external shock scenario*).

The CGE model in the report demonstrates that APEC economies stand to gain substantial increases in GDP from enhancements in Value Chain Resilience. The increases in GDP range between 0.9% or \$260 billion (Scenario 2) and 1.5% or \$460 billion (Scenario 3)<sup>7</sup>. Disruptions in value chains, as suggested by Scenario 4, show a quite modest impact of 0.3%. The low impact is most probably due to the strong connections that APEC economies have with non-APEC economies that enable opportunities for substitution of suppliers.

In terms of trade, under Scenario 1, exports gain for APEC is 6.1%, or \$374 billion annually. For Scenario 2, it is at 5.4% or \$332 billion; results from Scenario 3 show an increase by 9.6%, or \$593 billion in dollar terms. The last scenario, Scenario 4, sees exports fall slightly in APEC, by 0.6% or \$38 billion. Comparisons with other regional groupings, as well as the figures for imports, are provided below.

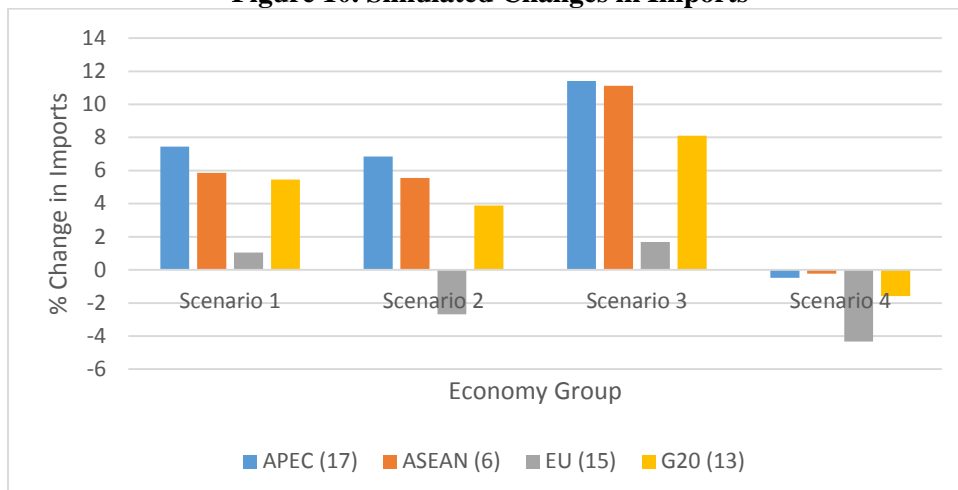
**Figure 9. Simulated Changes in Exports**



Source: APEC PSU (2014d).

<sup>7</sup> All figures are for one year, after all necessary economic adjustments have taken place.

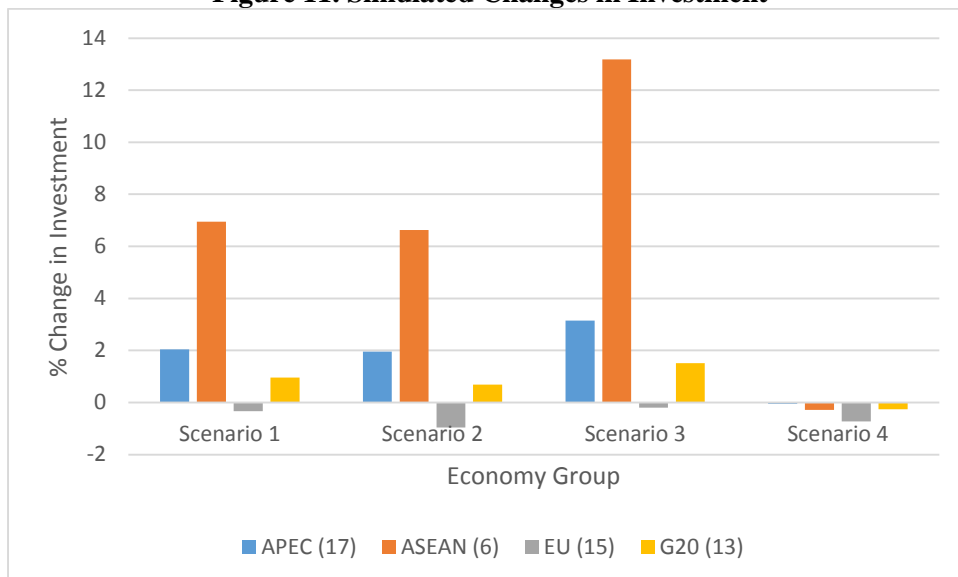
**Figure 10. Simulated Changes in Imports**



Source: APEC PSU (2014d)

For investment, results from Scenarios 1, 2, and 3 show that the value of investment increases significantly for APEC at around 2.0% or \$140 billion annually for Scenarios 1 and 2 (figure 11). While ASEAN has a higher percentage change, the nominal value for APEC is much higher, reaching nearly seven times higher. Scenario 4 shows only relatively weak impact for APEC, which is expected considering the diversification of APEC economies and the availability of alternative funding sources from regional savings.

**Figure 11. Simulated Changes in Investment**



Source: APEC PSU (2014d)

### 3. POLICY IMPLICATIONS

A number of important policy implications are provided from the four studies:

- 1) It needs to be emphasized that some types of Value Chain Risks—such as regulatory risk—are directly actionable by governments through relevant policy action. Policymakers thus have a large role to play in the process of managing and mitigating risk. With correct policies to minimize regulatory, political and market risk, governments could create an enabling environment where value chains could expand and prosper, generating positive outcomes on trade, investment, growth, and employment.
- 2) Coping mechanisms to mitigate disasters or economic shock will often involve efforts from multiple economies and parties. Applying a regional and partnership approach is a critical ingredient for a successful response to the occurrence of risks and disasters. It is important for APEC economies to learn established best practices from other regions and to push for ambitious concerted efforts.
- 3) Firms usually have their own risk management strategy in coping with disruptions affecting their supply chain as part of their business continuity plan. Still, governments also have an important role in creating a conducive environment that reinforces and promotes resilience.
- 4) The report for Phase 1 emphasized that VC Risk levels are low to moderate in the APEC region. Using OECD as a benchmark, APEC could further improve its performance on lowering risks under the natural disaster, regulatory and political categories. The Phase 2 report about VC Strength, on the other hand, noted the robustness of value chains in APEC with quick recovery to pre-crisis levels, albeit pointing out that APEC scores are still relatively lower compared to OECD under the category of strength against natural disaster and market risks.
- 5) There is a large role for government and the private sector to promote Value Chain Connectedness by reducing VC Risk and improving VC Strength. Value chains need a relatively stable and secure environment in order for them to operate efficiently. Firms, on the other hand, require certainty and reliability to maximize their performance; and the public sector could help business by putting in place systems that could handle identifiable risks as well as to mobilize resource to improve the domestic and regional response capacity.
- 6) With the current gap in Connectedness performance among developed and developing economies, APEC economies should work more closely with one another in bridging these gaps through facilitating trade, upgrading logistics networks, and addressing behind the border barriers. This will create a more cohesive regional and global trade network, help keep the cost of doing business across borders low, and reduce uncertainty in tapping into global value chains. This, in turn, will encourage more firms to tap into these global value chains, which will help sustain trade growth and further strengthen connectedness in the region.
- 7) Improvement of resiliency of Value Chains shows potential significant benefits in terms of GDP and trade gains. These in turn will lead to an expansion of employment

and potentially an increase in wages, which should benefit both skilled and unskilled labor. As such, policies and investments to strengthen Value Chain Resilience (VCR) will also provide inclusive benefits.

- 8) The results from the CGE model show that economic impacts from VCR improvements are higher under a most favored nation (non-discriminatory) basis. This provides strong justification for APEC's open regionalism principle.
- 9) APEC value chains are internally quite resilient; externally APEC economies also trade with many other different economies providing additional cushions. These resilient value chains and diversity of trading partners have enabled APEC value chains to recover fairly quickly when negative economic shocks hit.

## 4. CONCLUDING SUMMARY AND THE WAY FORWARD

The four studies show quantitative evidence regarding value chain resilience in APEC and the economic impact of resiliency in value chains. Broadly, value chain resilience in APEC is considerably strong; maintaining and strengthening this value chain resiliency will bring substantial economic benefits.

Overall, APEC economies face a moderate level of Value Chain Risk, but the scores of Value Chain Strength, as well as the experience from the case study, show that recovery after a crisis is relatively quick, minimizing the damages and disruptions to value chains. Lee, Preston and Green (2012: viii) explained that "...key sectors and businesses can be severely affected if a disruption to production centers or transport hubs persists for more than a week". The supporting role from the government has helped firms in coping with unexpected disasters and shocks; this in turn improves the resiliency of value chains. APEC should facilitate this further.

Connectedness can bring about many economic benefits by providing firms with opportunities for outsourcing and offshoring in addition to allowing closer access to markets. Society also benefits from employment opportunities as well as the products it brings to the market. Despite those benefits, Connectedness also carries with it more exposure to risks: the case study shows that negative economic shocks are transmitted more fully to more connected economies. This creates the need for an appropriate strategy to manage and handle the higher risks from stronger trade and economic integration and regionalization. Additionally, the overlooked risks and costs associated with offshoring strategy may reduce the expectations of cost savings for firms: for instance from around 25 to 40 percent to only 5 to 15 percent when firms consider the actual total cost that they have to bear (Ferreira and Prokopets 2009).

Park et. al. (2013: 97) highlighted three principal factors that create changes in the nature of risks under global value chains:

"First is the increasing number of firms found in supply chains and, thus, an increasing number of points for possible disruption. Second is the decreasing visibility and transparency that results from the increasing length of the supply chain, which in turn impedes detection and response efforts. Third is the increasing global consequences of local actions in a supply chain, which increases the risk of globally suboptimal results from locally optimal decisions."

Governments should focus on areas that are within their direct control; for example by crafting sound macroeconomic policies and to partner with business community to create awareness and solid emergency preparedness plan as a preparation to anticipate disasters and to build resilient infrastructures. These will help in creating a "common risk-conscious culture" across the supply chains (Lynch 2009).

Businesses, on the other hand, should also improve their respective countermeasure strategies in dealing with risks that could disrupt their supply chains. Handfield (2007: 36) suggested the following:

- i. Companies to develop supply chain strategies that considers disruption risk coming from globalization and product/process complexity.

- ii. Companies to prepare strategies to mitigate the impact of the above risks by improving visibility to key supply chain nodes for early detection of disruptions; preparing enough resources to support quick short-term recovery plans and adopting long-term collaborative approaches to minimize future disruptions.

There are many concepts related with ‘resiliency’ in value chains or supply chains as this topic is indeed multi-dimensional and multidisciplinary (Ponomarov 2012). Ponomarov (2012) further mentioned various definitions for resilience which include the concept of elasticity, stability, adaptability, quick recovery and the capacity to absorb or cushion against a particular shock or disruption. The WEF Global Risk Report (2013b) attempted to assess global risks through the lens of five components: robustness, redundancy, resourcefulness, response and recovery.

Based on the findings of the four studies and the existing literatures, we could offer the following key characteristics for a resilient supply chain:

1. **Robustness:** Firstly, a resilient supply chain should be strong enough to withstand normal shocks and changes. Robust supply chains should not be easily disrupted in the first place. Reliable transportation, power and ICT infrastructures and services are the necessary conditions for establishing a robust supply chain.
2. **Agility:** Agile supply chains could be defined from “their ability to rapidly, and cost-effectively, respond to change as enabled through the seamless flow of information from the market and across the supply chain” (Park et. al. 2013: 160). Speed is crucial in improving or building supply chain resilience. Agility is particularly important during recovery after a certain disaster as a resilient supply chain should be able to recover quickly from disruptions. The longer the time taken to recover, the more damages could occur, and the more complex is the situation to be resolved.
3. **Flexibility:** Resiliency in supply chain could be improved by having more options and alternatives during normal times and during recovery. Multiple suppliers will provide lead firms more options to anticipate or react to changes. Christopher and Peck (2004: 15) noted that, “Single sourcing, where one supplier is responsible for the supply of a specific item or service may be advantageous from a cost and quality management perspective, but is dangerous in terms of resilience”.
4. **Redundancy:** to maintain agility and quick recovery, firms and governments may need redundancy or surplus capacity implanted in their system (McKinnon, 2014). This could be in the form of buffer stocks, spare budget for emergency purposes, and a thorough preparation of Business Continuity Planning strategy.

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