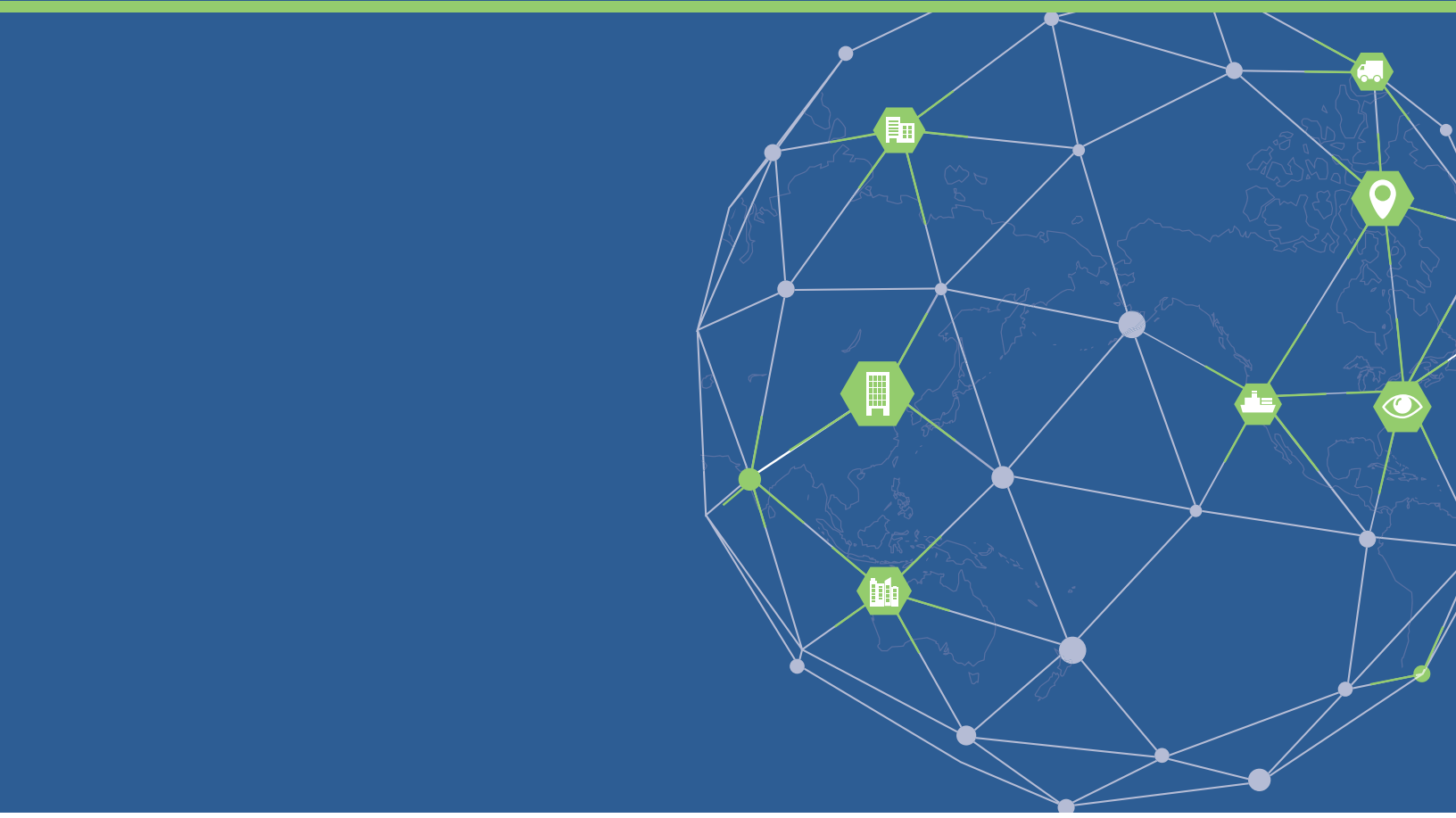


A New Metric for Measuring Supply Chain Resiliency:

An Introduction to Resilinc R Score™ and its Application to the High-Tech Industry Supply Chain

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Abstract

This paper introduces a new metric for measuring supply chain resiliency. The authors discuss the need for a new metric and the historical challenges associated with creating a standard way to measure resiliency. The paper introduces the Resilinc R Score™ and explains the methodology for computing the score, breaks down the score into its elements and explains how the calculation works. The R score™ can enable a company to enhance its sourcing process (by having greater understanding of a potential suppliers' resiliency). It also provides a capability to communicate internally to leadership regarding the current status of their overall program and areas for further improvement, which are top of mind questions for BOD, CEO/CFO, Underwriters, etc. The R Score™ provides a measurable framework to benchmark with competitors and industry peers and over time, show progress on improving their program. The methodology is applied to over 3,000 companies in the High-Tech industry supply chain, of which about 50% are Tier 1 and the rest are Tier 2 suppliers. It breaks down the average vs. best in class scores for each element and explains the industry or company level characteristics that affect the score and provides recommendations for how industry executives can use the score to influence change and measure progress over time.

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Introduction to Supply Chain Risk and Resiliency Metrics

Supply chain management is a metrics-driven field. In a discipline that relies so heavily on metrics and KPIs, one key area has escaped any industry standard metric thus far - Supply Chain Risk. This is why most companies have not adequately focused on managing risk and investing in processes, intelligence, analytics, solutions or incentives for improving their risk profile.

In the absence of a single risk metric, supply chain leaders have been unable to articulate the resiliency or risk profile of their own business. They cannot describe how their supply chain resiliency or risk profile compares to that of similar companies and competitors. As such, they are unable to differentiate themselves or demonstrate their superiority or strengths in a quantifiable and acceptable way. Quantifying the benefits of investing in resiliency is difficult because it is equally difficult to articulate the impact of investing a dollar in building key risk management capabilities to reduce the risk profile of the supply chain.

The human genome mapping project took years to undertake, but yielded rich diagnostics and causal intelligence for critical genetic diseases. This led to development of targeted treatment for life threatening genetic diseases.

Challenges of Measuring Risk and Resiliency

Largely, the challenge is grounded in the lack of availability of the underlying data. A company's supply chain needs to measure the strength of the network, which, by definition lies outside the four walls, and spans the globe and encompasses multiple supply chain tiers.

In the financial industry, the availability of financial health reports such as those published by Dunn & Bradstreet, Rapid Ratings and many others was preceded by the widespread availability of standard financial statements. This information could be converted into standard metrics and scores, benchmarks, and assessments could be generated based on them.

But no such standard supply chain data set existed that could be leveraged. Nor was a single repository available for the thousands of companies involved in any industry's global supply chain. Companies have attempted to put together comprehensive risk scorecards, but the lack of availability of data has stymied these efforts.

Mapping the Supply Chain Genome

Resilinc has been working on mapping the supply chain genome for the past six years, one industry vertical at a time. The first step was to standardize the data collection process and define the inputs required to drive intelligent risk measurement and resilient decisions. Resilinc introduced the world's first standardized supply chain mapping data input template in 2010 along with a robust cloud-based data collection and refresh engine using Resilinc's LinkedIn-like platform and connected, real-time supplier network. The next step was to begin data collection. In 2012, Resilinc began mapping the High-Tech supply chain using the standard data input template. By 2014, Resilinc was mapping suppliers across the High Tech, Automotive, Medical Devices and Life Sciences industries.

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By 2016, Resilinc had amassed tremendous intelligence for over 40,000 companies' supply chains. Resilinc achieved this by working with tens of thousands of companies to map their global footprint, part origin, recovery and business continuity capabilities and sub-tier connections. Resilinc is today, the world's largest single repository for deep supply chain mapping intelligence spanning over 70,000 manufacturing sites, almost 2 million parts and over 60,000 sub-tier connections.

Depth and Breadth of Data in Resilinc's Global Supplier Intelligence Repository as of 2017



Resilinc has mapped approximately 95% of the High-Tech supply chain, about 80% of the Life Science/Pharma supply chain, and about 50% of the Automotive Supply Chain.

This intelligence has laid the foundation for building robust metrics. In 2017, Resilinc has introduced the Resilinc R Score™ as an industry standard metric for measuring resiliency.

The State of the Art for Measuring Resiliency

In the seminal book "The Resilient Enterprise", Prof. Yossi Sheffi of MIT popularized and outlined the importance of supply chain resilience. Resilience, by definition, is the capacity to recover quickly from difficult situations and is an intrinsic quality of a person, object, material etc. Building on this notion then, resilience can be measured, if one has information about the object's characteristics. Similarly, the resilience of an organization's supply chain capabilities can be measured, if we have information about key things such as: the quality of decisions made at all levels, such as where to manufacture, what to second source, how much inventory to have, how much redundancy to invest in, how it performs operationally, what its weakest links are, how strong it's relationships are with other upstream and downstream supply chain partners etc. These decisions collectively determine how quickly and effectively the organization can recover from disruptions. More importantly, these decisions are within the direct control of the company and therefore, can be influenced and improved. For this reason, the R Score measures RESILIENCY as a function of these elements that describe an organization's business practices.

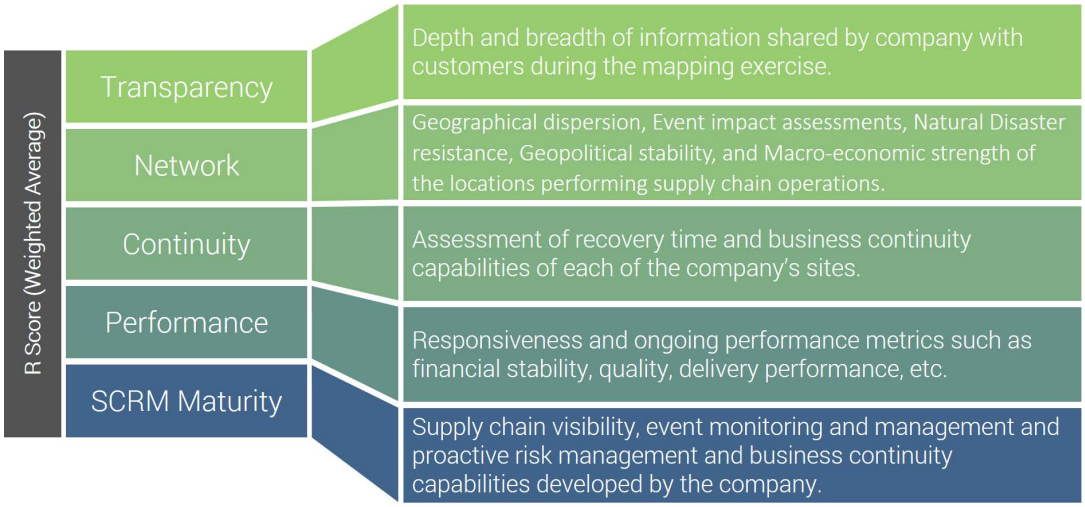
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Understanding the R Score Elements

Resilinc R Score is a comprehensive assessment of a company's supply chain resiliency. The R Score graphic shows the company's score, a comparison of the company against industry average vs. best in class, as well as the change from previous quarter. The Resilinc R Score **evaluates, benchmarks, and ranks** companies on the following key metrics: Transparency, Network Resiliency, Continuity Robustness, Performance and Supply Chain Resiliency Program Maturity.

The Score has a scale of 1 to 10, the higher score indicating a stronger resiliency profile. The score is recomputed every quarter. The methodology used to compute the score is described below in the following paragraphs.





The R score can enable a company to enhance its sourcing process (by having greater understanding of a potential suppliers' resiliency). It also provides the capability to communicate internally with leadership teams regarding the current status of their overall program and to create a road map for future improvements. These are often questions that are top of mind for Board of Directors, CEO, CFO, Internal Audit Leaders, Underwriters, etc. On the sales side, the R Score can be used by companies to differentiate their superior resiliency capabilities against competitors or industry peers, and thereby, use their supply chain resiliency to win business and grow.

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Understanding the Transparency Score

Customers can control their supply chain performance better if they have more information available to them from their suppliers. They can pinpoint problems accurately, collaborate with their suppliers quickly and therefore, respond swiftly and effectively when problems arise. Therefore, transparency is the foundation of a robust supply chain resiliency program.

The level of transparency is important, because it indicates the level of trust between a customer and a supplier. It requires tremendous amount of trust on part of a supplier to disclose the composition of a specific part/raw material and list the sources where each is purchased. Trust is foundational to a long term partnership. Therefore, a supplier who is highly transparent is worthy of being a long term partner.

The transparency score measures suppliers based on the depth of supply chain mapping data they have shared with their customers, through the Resilinc platform.

Level 1	Site information only
Level 2	Sites mapped to parts made there
Level 3	Second Tier Suppliers
Level 4	Second Tier Suppliers and Sites
Level 5	Second Tier Suppliers, Sites and Commodities Purchased
Level 6	Part Level visibility shared i.e. suppliers provide the raw materials/parts used to make a specific part purchased by the customer, and list sources of each such raw material/part.

Finally, the scores are adjusted for aging of the data. The score deteriorates the longer the data ages. Suppliers at the same level, but who frequently update and refresh the data often, score higher.

Suppliers sharing Level 6 visibility, embody best in class and get the highest points. Other levels are tied to lower score

The supplier has a **high level of influence in improving this score.** The more information shared by the supplier, the higher their score. Ensuring the information is updated and refreshed frequently guarantees the scores will consistently remain high.

Understanding the Network Score

The network score is a comprehensive measurement of the company's supply chain footprint. It takes the sites provided by the suppliers on the Resilinc platform, and calculates the following key metrics:

- Geographic Dispersion considering the number of countries the supplier operates in
- Site Level Natural Disaster Resistance
- Site Level Geopolitical Stability
- Site Level Macroeconomic Stability
- Site Level Number of EventWatch Notices Issued

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Since a supplier may have any number of sites globally, the network score is an average of all the sites in the system.

The supplier will have a **limited ability to influence the score in the near term.** This is because location changes in an industry as complex as High Tech is time consuming.

Understanding the Continuity Score

The continuity score evaluates the business continuity capabilities a company has implemented to resume operations in the event of a major disruption. It also accounts for the availability of an alternate site, the estimated time it takes to start shipping after a disruption, and time to resume its full pre-disruption run rate. It is an important measure of the capabilities each site has implemented to recover within an acceptable timeframe, keep customers notified, and activate the crisis response and recovery plans etc. that are in place within the company. The score is calculated for each site as shown below, and then aggregated to compute the company level continuity score.

$$\text{Continuity score}_{\text{Site}} = \text{Avg.}\left\{\text{Rec Score}_{\text{Site}} + \text{Bring Up Score}_{\text{Site}} + \text{BCP Score}_{\text{Site}}\right\}$$

Recovery Score = Score based on estimated time taken to resume 100% of pre-disruption run rate

Bring Up Score = Score based on estimated time taken to start shipping after a disruption

BCP Score = Business Continuity Score based on a quantitative assessment of each site's BCP capability (ISO22301)

The company has a **high level of influence** over this score. Focusing on comprehensive business continuity programs at each site and ensuring they comply with ISO22301 standards can get the company to full points on the BCP score component. Additionally, some sites may be able to reduce recovery times or times to resume supply by pre-qualifying alternate sites, or holding inventory in a different location wherever possible. This will further help improve the continuity score.

Understanding the Performance Score

The performance score aggregates Resilinc customers' rating about their suppliers. Without identifying the customer, Resilinc normalizes and aggregates customer provided supplier scorecard, which can vary company by company. While the methodology, metrics, weights etc. vary company by company, most of Resilinc's customers measure supplier performance across the following elements:

Ease of Doing Business	★★★★★	Financial Health	★★★½
Price Competitiveness	★★	Technology and Innovation	★★★★½
Adaptiveness and Flexibility	★★★★★	Sustainability and CSR	★★
Quality and Reliability	★★★	Compliance	★★
Delivery Performance	★★★★	Change Notification Policy Adherence	★★

Performance metrics such as these are integral to resiliency. This is because metrics such as these demonstrate the company's operational discipline and excellence. A low score on these metrics can highlight systemic issues: these could be gaps in internal business processes, ongoing problems with execution as well as gaps in robust management systems. A diminishing performance score can also be a leading indicator of future problems.

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As more customers share their supplier ratings, the supplier will need to truly improve overall performance on all the above metrics to improve their score. Thus, the supplier's **ability to quickly influence** the score in the near to medium term will be **limited.**

Understanding the Supply Chain Resiliency Program Maturity Score

Resilinc believes that suppliers should be responsible for, and take ownership of their own supply chain resiliency. This means that they must acknowledge the risks inherent in the supply chain and invest in best practices over time to improve visibility, monitor events for early warning and put in place proactive and post event response and mitigation playbooks. Training the organization and ensuring people, processes and incentives for employees and suppliers are aligned to promote resilient thinking and risk-adjusted decision making.

Resilinc uses the maturity model below to provide a framework and roadmap for measuring and rolling out resiliency capabilities. The self-assessment takes into consideration the suppliers' level of sophistication and adoption of industry best practices. Resilinc's experience is that the journey to full maturity takes 3-5 years as it requires extensive change management before metrics, incentives, policies and processes can be aligned to support resiliency objectives.

The maturity model lays out the step by step journey an organization can take as they start implementing their resiliency program. It outlines the key initial steps, technologies, intelligence, processes changes that are required to complete each stage before moving on to the next one. It is based on working with more than 35 companies who have implemented this over a five-year period. Culture, processes, behavior and incentives change slowly, and imposing change can often lead to ad hoc adoption.

The maturity model eases the organization into these changes, enables the change to come from within. Because it starts with deep supply chain intelligence becoming available to people, it creates greater awareness of risk and fuels the desire to be resilient at every level of the organization.

Supply Chain Maturity Model

	Reactive	Aware	Proactive	Integrated	Resilient
People	• Crisis Team emerges out of Necessity • No SCRM Resources	• Crisis Team is developing, • Formal team with dedicated and trained functional leads not in place • Limited SCRM resources	• Trained and dedicated Crisis Team with Functional Leads • Category Managers have full visibility to supplier's emergency contact • Dedicated SCRM resources • Risk Governance Board with Exec leadership is developing	• Crisis Team lessons learned incorporated into playbooks and mitigation strategies • Category Managers proactively mitigating supply chain risks measured against targets • Rewards/Incentives tied to mitigation metrics achieved • Risk Governance Board with Exec leadership formed	• BUs, Enterprise risk team, Finance teams collaborating regularly • Ongoing widespread collaboration with suppliers for improving resiliency • Risk Governance Board expects regular readouts • Career growth plan defined for SCRM experts
Process	• No proactive monitoring of supply chain events • Reactive approach to managing crises • Limited understanding of supply chain footprint and vulnerabilities • No clear strategy or playbooks • No proactive mitigations	• Emerging visibility to supplier site locations, parts to sites mapping and recovery times • Review of visibility progress on an ongoing basis • Event response process is set up based on severity	• Crisis recovery playbooks developed • Risk thresholds are defined • Risk is quantified and prioritized based on revenue and impact • Proactive risk mitigation strategies developed • Comprehensive risk repository formed • Initiate collaboration with CBI insurance providers	• Key risks and failure points are reviewed and roadmap is defined • Mitigation progress goals are set/ reviewed periodically • Supplier contracts reference BCPs and recovery times in force majeure clauses • Review BCP improvement plan at supplier QBRs • Annual insurance provider review and coverage driven by the exposure analyzed	• Formal review of critical sub tier supply chain partners in place to mitigate aggregation • Risk program, metrics and progress reviewed regularly all the way to board level • Risk insights considered for sourcing, network and product design decisions • Supplier incentives set up to drive transparency and improve resiliency • Risk metrics integrated into supplier scorecard and QBRs • Expand resiliency program to subsidiaries and affiliates
Technology	• Support tools unavailable • Excel and off-line tracking of data	• 24 X 7 event monitoring initiated • Virtual event war room and What If tools connected to visibility data • Supply chain Mapping Initiated • Supplier BCP Collection initiated • Automated supplier outreach during disruptions is initiated	• Supply chain mapping extended to sub tier risk identification and aggregation • Mitigation Wizard used regularly to track actions • Operational scorecard combined with supplier risk score • BCPs collected for critical suppliers/ sites • Use of Technology as the system of record to remove silos • Suppliers start responding to disruptions systematically	• Mitigation Module to show progress to management • Supply chain Mapping conducted across all critical products • Resiliency program expanded to include capacity, CSR • Supplier response • 80% plus suppliers responding regularly to confirm impact within hours • Sub Tier surveys initiated for critical sub tier failure points	• Sub Tier BCPs collected for sites with high exposure • Annual multi party table top exercises conducted to test response effectiveness • Broad based user adoption of technology across functions and frequent usage • End to end supply chain mapping conducted and data refreshed across all critical products on an ongoing basis

Note: Adapted from the Supply Chain Risk Leadership Council Maturity Model

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One area where Resilinc helps suppliers is that when a supplier joins the Resilinc platform, they receive notifications any time a disruption occurs in or around one of their facilities. The suppliers are notified about the disruption and an automated request to confirm impact is sent. **As of December 2016, just under 20% of suppliers (approximately 600) were responding to these notifications.** These suppliers were given credit for looking at and responding to Resilinc's alerts and requests, because while they themselves had not investing in 24x7 monitoring, they were benefiting from their customers watching their sites.

The suppliers' **ability to influence** the Score in the **near term** is somewhat **Limited**. At the very least, they can begin to pay attention to Resilinc's alerts. However, **suppliers' ability to influence** the score in the **medium term** is **VERY HIGH** because of the following steps they can take:

1. Respond consistently to Resilinc's alerts and request for impact confirmation
2. Invest in supply chain mapping and 24x7 event monitoring capabilities
3. Complete the Resilinc self-assessment available on the Resilinc website
4. Get Resilinc or a Resilinc customer to conduct an audit of their SCRM program maturity and confirm that the capabilities listed in the self-assessment have been observed.

Which Elements can Companies Influence: Sensitivity

The table below shows the R Score sensitivity to the various elements and the degree and speed with which companies can affect change. The metrics that have the highest weight on the R Score are Transparency and SCRM Program Maturity, followed by Continuity Score.

Of these, Transparency is the one metric where near term ability to influence is high.

A robust mapping and monitoring program helps counter risk that could originate from any source. Information is power, and detectability is the one big variable that can give a company a leg up during an event. Therefore, making a strong commitment to resiliency and investing the time and resources to implement, grow and operationalize best in class practices gets high consideration.

Speed to affect change

Ability to Influence the R Score

	Near Term	Medium Term	Long Term
Transparency	High	High	High
SCRM Maturity	High	High	High
Continuity	High	High	High
Network	Low	Low	High
Performance	Low	High	High

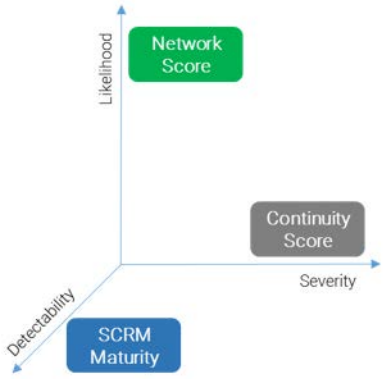
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How to Use the R Score and Elements to Drive Improvement

The R Score measures a supplier's ability to ship products on time, irrespective of any external or internal challenges. The 3x3 shows how the R Score elements provide insight into the type of vulnerability a supplier might have whether their network is inherently vulnerable, whether they have weak continuity capabilities or whether detectability and therefore response capability is low. Knowing this information can help identify the precise mitigation strategy to help alleviate this specific vulnerability, rather than try to implement one size fits all strategies like inventory or second sourcing.

Thus, the R Score enables companies to make investment and improvement decisions that are grounded in a robust intelligence driven framework by understanding the three key factors:

- Likelihood of an event – as represented by the Network Score
- Severity – as represented by Continuity Score
- Detectability – as represented by SCRM Maturity Score



Likelihood	It is the risk of an event affecting your supply chain. Your Network Score highlights the extrinsic risk associated with your global footprint
Severity	Severity is the impact magnitude of an event to your supply chain. Companies can reduce event impact through better BCP plans, better event management and response programs, etc. These elements are highlighted in the Continuity Score.
Detectability	Detectability is determined by the availability of mapping information and a continuous event monitoring capability. SCRM Maturity Score measures a company's ability to detect, predict impact and respond quickly and cost effectively to a supply chain disruption.

If the Network Score is low, that means the supplier has a vulnerable global footprint. This means the suppliers needs to invest in site redundancy and ensure critical high revenue products have alternate sites qualified.

In addition to the above, R Score also places emphasis on:

a. Transparency - Sharing information with your customers can greatly improve the resiliency of the customers (customers can detect and respond quickly). Companies that are sharing information are helping the entire supply-chain become more resilient.

b. Performance – Day-to-day, seemingly small, operational disruptions can add up over time and create inefficiencies and disruptions in the supply chain e.g.: quality issues, delayed shipments, recalls, etc. The performance score measures ongoing performance of the company. This is because performance problems or deterioration over time can often be a leading indicator of future problems, or inherent operational weaknesses.

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Network	Continuity	Maturity	RESILIENCY	Suggested Mitigation
L	L	L		Need to improve Continuity and Maturity Capabilities to protect network vulnerability
L	L	H		Network is vulnerable and continuity is not robust. Sensing and response not sufficient, because network is vulnerable.
L	H	L		Strong continuity helps offset network risk but low maturity means vulnerable to supplier risks
L	H	H		Network risk is offset by strong continuity and strong detectability and response capabilities.
H	L	L		Not protected from events like factory fire, chemical spills, explosions etc. as well as supplier risks
H	L	H		Footprint not protected, but ability to detect, sense and respond proactively to supplier network risks helps avoid worst case scenarios
H	H	L		Not protected from risks originating outside the company's footprint (supplier risks)
H	H	H		This is best in class!

Is the R Score the Perfect Metric?

The R Score as of 2016 is a starting point – it is currently at version 1.0. We expect it to evolve over time as we receive feedback from suppliers, customers and other expert advisors. As the industry reviews the score, the methodology, and elements used to calculate it and provides us feedback and ideas for improvement, the R Score will evolve and improve.

Additionally, Resilinc believes that over time, more data and data sources will further enrich our ability to provide a well-rounded supply chain scorecard. Resilinc is actively working with partners for increasing sources of data that can help enhance current elements or add new elements.

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High-Tech Industry R Score Overview

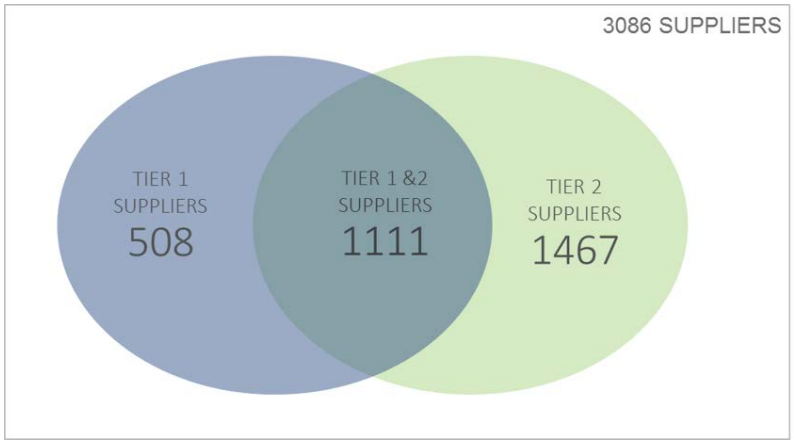
For 2017, Resilinc has generated R Scores for over 3000 companies in the High-Tech industry. The qualifying criteria for a company's R Score to be computed are:

1. Company's data must be present on the Resilinc platform as a direct or sub-tier supplier of any customer of Resilinc.
2. To be considered a High-Tech industry supplier, company must be a direct or sub-tier supplier to any of Resilinc's High Tech customers or their tier 1 suppliers and must have approved at least one customer's access to their information. These are Resilinc customers like IBM, Dell, Juniper, Palo Alto Networks, Micron, Western Digital, Bose, Microsoft, NVidia, NetApp, Aruba Networks (HPE), etc.
3. The following minimum data elements must be available to Resilinc about global locations (factories, warehouse, distribution/logistics center etc.), event frequency at these sites, responsiveness, maturity in terms of response to Event Notifications.

Understanding Suppliers by Tier

The figure below shows how the suppliers are positioned within the supply chain by Tiers. Tier 1 suppliers are direct suppliers of Resilinc's customers. Tier 2 suppliers are suppliers of the Tier 1 suppliers.

Tier 1 and 2 Breakdown of the High-Tech Suppliers Included in the Study



The 3,086 suppliers included in the study includes a total of 1,619 Tier 1 suppliers, of which 1,111 suppliers are also Tier 2 suppliers (they are a supplier to another Tier 1 supplier). All 1,619 suppliers are included as Tier 1. There are 1,467 suppliers who are uniquely Tier 2 suppliers.

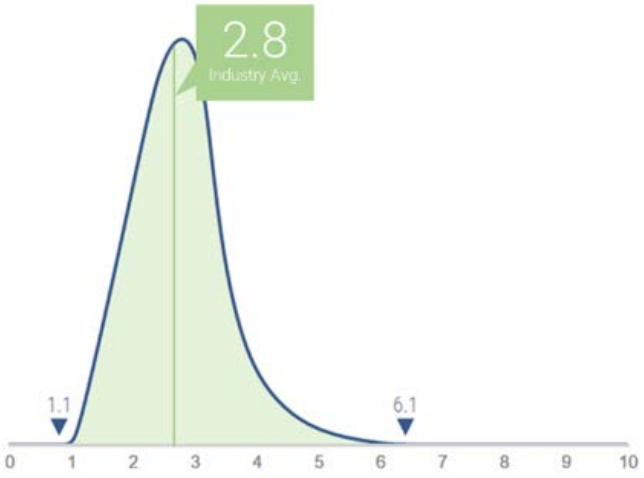
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Industry R Score Report Card

Overall, the supply chain resiliency score for the industry is 2.8. The lowest score is 1.1 and best in class score is 6.1. Tier 1 suppliers' R Score averages 3.2. Tier 2 suppliers' R Score averages 2.4.

There are 25 companies who truly stand out and are best in class in their industry segments/categories. They are the innovators and early adopters of supply chain resiliency best practices.

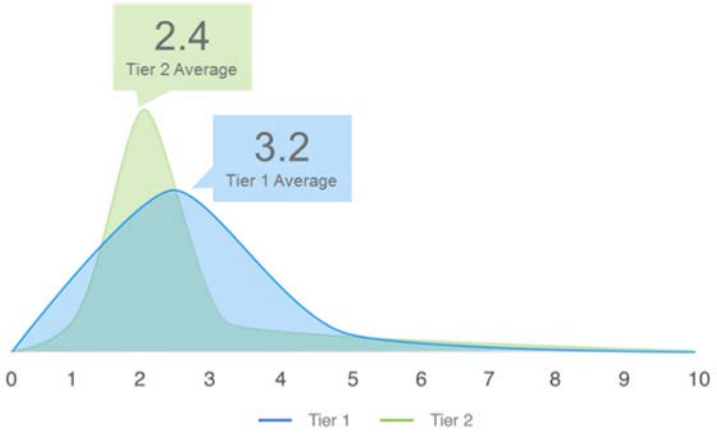
High-Tech Industry R Score Distribution



Source: Resilinc

Below is the distribution of the two tiers of suppliers. The Tier 1 suppliers on average have a higher R Score distribution range. One primary reason for this is that they have been participating in the mapping process for many years, and therefore a richer data set is available to derive R Scores.

Breakdown of High-Tech Industry R Score by Tiers



Source: Resilinc

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Breakdown of the High-Tech Industry R Score into Elements

The average scores for the five elements of the R Score for companies in the industry are as follows:

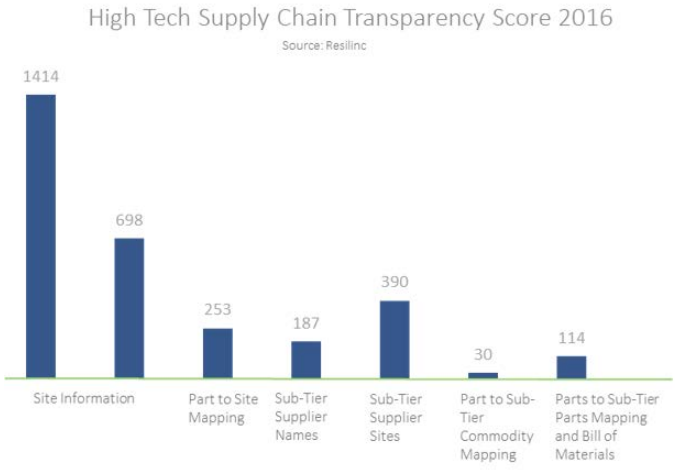
	Transparency	Network	Continuity	Performance	Maturity
AVERAGE →	2	4.4	1.5	4.5	1.6
BEST IN CLASS →	9	7.1	7.9	9	10

Overall, suppliers scored low on Transparency, Continuity and Supply Chain Resiliency Program Maturity. Relatively speaking, network resiliency and performance scores are in medium resiliency range.

There are tactics that can be quickly implemented, which can help these companies improve their score and their resiliency. By investing in key capabilities such as supply chain monitoring, mapping, business continuity and proactive risk mitigation, we believe companies can improve resiliency and improve their score.

High-Tech Industry Transparency Score

The average transparency score is 2. The lowest score is 1.5 and the best-in-class score is 9. As the chart demonstrates, almost all suppliers are comfortable sharing information about their geographic footprint with their customers. Almost 1,000 Tier 1 suppliers (out of 1,600 Tier 1s) also map specific parts to the factories, wafer fabs, warehouses, distribution centers etc. that they touch. Over 700 Tier 1 suppliers (50%) also share names of sub-tier suppliers.



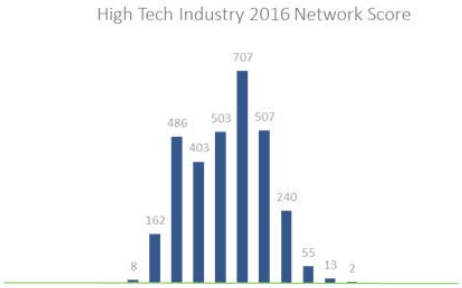
Best in class in this category are the 144 suppliers who share tier-2 commodity sourcing (30 suppliers) or part level Bill of Material information (114 suppliers). Clearly, these companies are highly differentiated compared to their competitors. Customers trust them, there are no surprises, but tremendous collaboration on joint quality, resiliency, and other initiatives between these companies, and certainly suppliers consider customers to be long term partners.

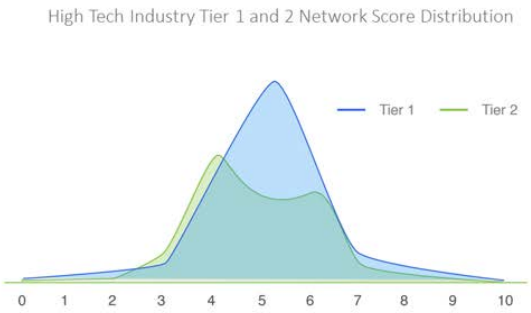
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Additionally, this also alleviates the common concern that sharing this information might enable a customer to source directly from a sub-tier partner. Clearly, there are many companies who have been fully transparent with customers, and have not experienced any negative effects from full disclosure.

High-Tech Industry Network Score

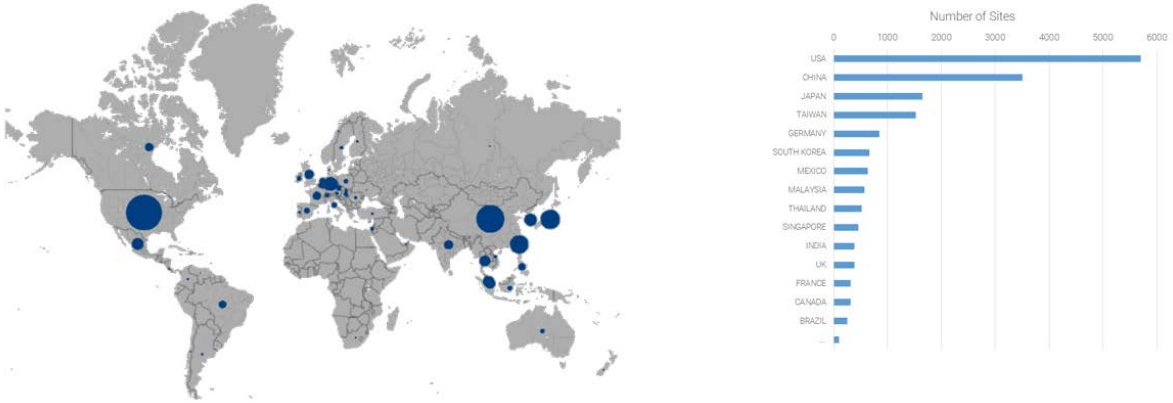
The network score for suppliers on average is 4.4, with the highest score being 7.1. Below is the distribution of the scores for the industry overall, as well as a view of the network score distribution between Tier 1 suppliers vs. Tier 2s





The supply chain encompasses factories, warehouses, distribution center locations, service locations across 87 countries worldwide. The chart show the number of sites by country. The top five countries with site concentration are: US, China, Japan, Taiwan and Germany.

Geographic concentration of all High-Tech Industry Supplier sites

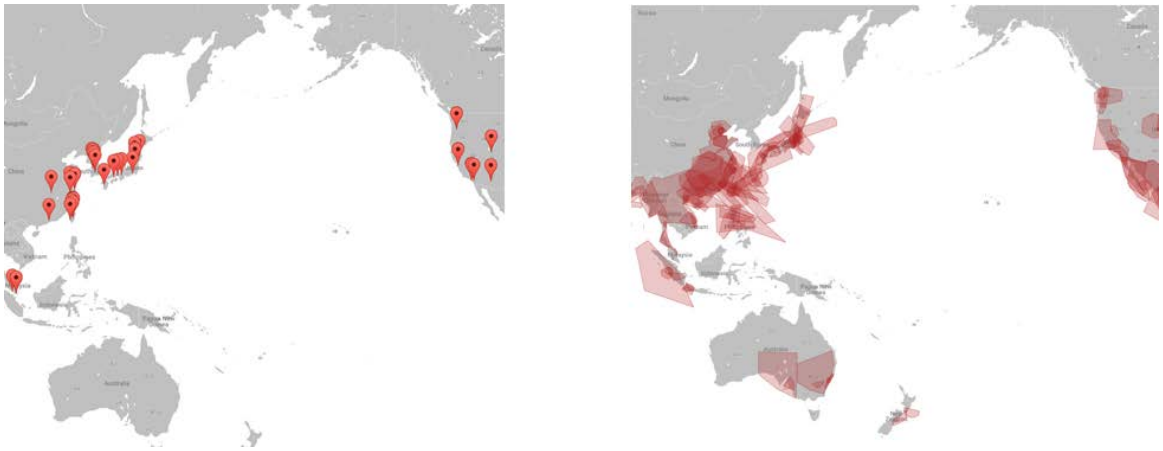


Source: Resilinc

The industry supply chain network has several key failure points, including the **large concentration of 371 wafer fabs in the Pacific Ring of Fire region.** Additionally, due to the geographic diversity, the extended global supply chain, and prevalence of sites in earthquake and hurricane regions of the world around the Pacific, the frequency of disruptive events is very high. The figure on the left below shows the wafer fabrication sites in the Pacific Ring of Fire region, and the figure on the right below shows the region experiencing disruptions. The overlapping regions show the higher frequency of disruptions tracked by Resilinc EventWatch between 2013-2017.

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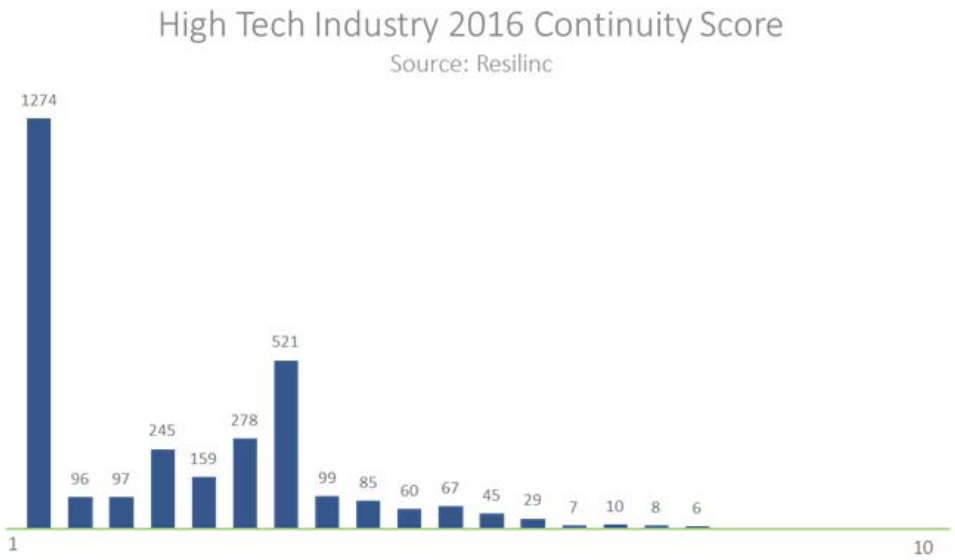
Wafer fabrication locations concentrated around the Ring of fire Vs. Events reported (2013-2017)



Source: Resilinc Database

High-Tech Industry Continuity Score

The industry average Continuity score across the 3,000 companies is 1.5, and the best in class score is 7.9. Numerous companies have invested in continuity measures, but there still is a significant portion of the industry that have medium to high network risk with relatively low investments in continuity. Additionally, the business continuity capabilities are generally implemented in an ad hoc fashion, and don't always adhere to industry standards such as ISO22301.



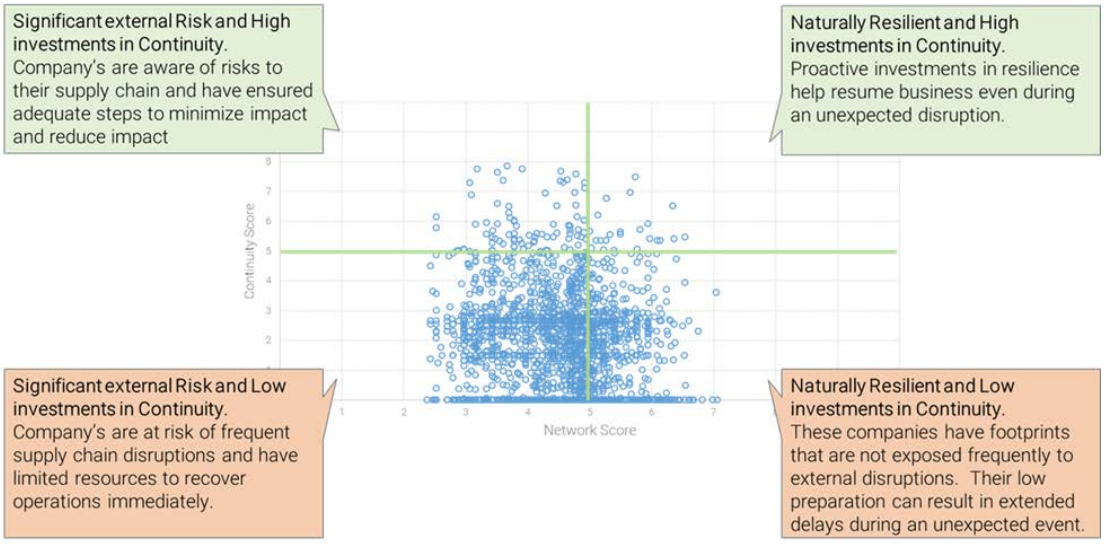
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Using the Network and Continuity Scores

Comparing continuity score to network score shows that not all companies are prepared to recover quickly from the inherent risk in their network.

It is important to note that a high network score indicates a naturally resilient network, meaning that the company's sites are located in areas that are not vulnerable to earthquakes, floods, hurricanes or in geopolitical hotspots. However, disruptions such as factory fires or chemical hazard, or explosions etc. can happen anywhere, and that risk is not measured in the network score. **Therefore, a high network score does not mean that the company can reduce investment in continuity or SCRM maturity programs.** A strong continuity program can help recover and resume operations quickly in the event of any kind of disruption, irrespective of frequency of occurrence. Companies that are not prepared can cause significant disruption to the overall network.

When comparing Continuity score to Network score, we see that all companies have continuity measurements that alight with their network's inherent risk.



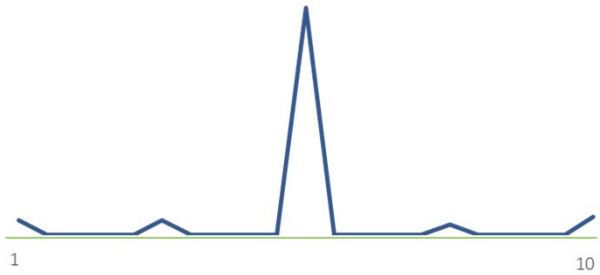
Due to the complexity of the high-tech manufacturing process across many commodities, particularly semiconductor manufacturing processes (wafer fabrication and clean room environments, for example), the time needed to recover from a major disruption can be long. On average, the recovery time runs into 33 weeks across the entire data set, and in some companies, can be as long as a year. Recovery time considers the need to replace complex manufacturing equipment in the event of damage to a site. In some cases, equipment replacement lead times can range from 10 to 26 weeks. Add to that the time to setup, qualify, build and test samples, run the manufacturing process and transit time and the recovery time can quickly add up. This further reinforces the need for High Tech companies to have very robust continuity programs in place to keep recovery times within acceptable thresholds.

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High-Tech Industry Performance Score

The average performance score is 4.5 and highest score is 9. A limited number of Resilinc customers currently share supplier quarterly supplier scorecard and key performance indicators (KPIs) with Resilinc. Also, each company measures different supplier KPIs. Resilinc aggregates supplier KPIs across all customers to determine performance score. Additionally, suppliers' responsiveness, in terms of speed, to requests for mapping information and customer support and willingness to support the mapping process.

High Tech Industry 2016 Performance Score
Source: Resilinc



Note: As of 2016, the score is weighed more by suppliers' responsiveness to the mapping requests as measured by Resilinc. This is because only a limited number of Resilinc's customers load supplier scores in Resilinc. Additionally, most companies do not score all suppliers, but rather the highest spend Tier 1 suppliers only, which is typically, about 20% of the suppliers who constitute 80% of the spend. Therefore, performance scores are available for about 500 suppliers Tier 1 suppliers. Therefore, the availability of performance scores across all suppliers is not consistent. We fully expect this to change in the coming quarters and years, as more customers become aware of the R Score, and broaden the scope and range of suppliers they measure and metrics they rate. Resilinc is partnering with several customers and data expert for additional metrics and scores pertaining to supplier performance in coming months.

The suppliers' **ability to influence** this score in the **near term is HIGH**. Because the score is heavily weighted by responsiveness to mapping requests, suppliers can respond and complete mapping and data refresh requests quickly to realize high scores.

High-Tech Industry SCRM Maturity Score

The average score is 1.6 and the highest score is 10. The information required to gauge SCRM maturity across all 3,000 companies is not readily available today, even with Resilinc. The discipline of supply chain resiliency is relatively new, and therefore, we have seen in our interactions with companies, that most companies have not invested in this capability yet. High Tech OEMs have been communicating since 2006 about the need for suppliers to maintain a strong focus on supply continuity practices and to take ownership of their own resiliency. We attribute the underinvestment in this area primarily to the lack of a measurable metric and benchmark.

There are 10 companies out of 3,000, who stand out because of their leadership in this area. Many of these companies made the R Score Top 25 list. For many of these 10 companies, between 60-85% of their suppliers respond to EventWatch notices.

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A Strong Outlook for the Industry

The early adopters and innovators have embarked on their journey 3-4 years ago. The rest of the industry must now follow watch, benchmark, learn, and adopt. The good news is that the High-Tech industry is six years ahead in the resiliency journey than the rest of the world because of the efforts of companies like Cisco and IBM, who took the first concrete steps in this discipline early on, and others like Western Digital, EMC (Dell), Juniper Networks, Palo Alto Networks and many others, who have been tirelessly educating the market since 2011.

The vision of the R Score is to begin the conversation within the company around a measurable baseline. The goal is to provide executives with the score and the benchmark and drive the question of: how can we improve this, and task their teams with a measurable goal and time target within which to achieve it.

Ultimately, resiliency cannot be achieved by any one company in isolation. Resilinc customers have made a strong commitment to being resilient but their suppliers need to participate in this journey too. A resilient supplier not only protects the customer but also their own revenues and business. Resilinc's goal with the R Score is to bring resiliency to every link, and every node in our customers' supply chain because resilient suppliers mean resilient (and delighted) customers.

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Yossi Sheffi, The Resilient Enterprise, 2005, MIT Press

Yossi Sheffi, The Power of Resilience, 2015, MIT Press

Resilinc EventWatch

Resilinc Global Supplier Intelligence Repository

Resilinc Supplier R Score™ Metrics Database

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Who Made It Possible

Resilinc Customers

All Suppliers Partners on Resilinc Platform

Resilinc Data Operations Team

Resilinc Partner Relations Team

Resilinc EventWatch Team

Resilinc Customer Success Team

Resilinc Engineering Team

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About the Global Supply Chain Resiliency Council

The Global Supply Chain Resiliency Council was formed to bring together supply chain risk management and resiliency practitioners with luminaries and educators to advance the professional discipline through opportunities to collaborate, develop and share best practices, and be recognized for innovation and leadership. A key goal of the Council is to elevate the profile of supply chain resiliency business challenges and opportunities vis-a-vis the C-level strategic agenda.

To that end, the Council awards supply chain resiliency at its annual Global Supply Chain Resiliency Council and Awards event. The awards program is designed to recognize organizations and individuals that serve as role models and leaders in driving supply chain resiliency strategy success within their company, supply chain community and across industries. The awards committee considers nominations received from suppliers, customers and experts from the Council's technical adviser, Resilinc. In 2014 and 2015, resiliency programs receiving recognition included companies like Amgen, Palo Alto Networks, Bose, Western Digital, etc. The awards are handed out in the spring, but companies are encouraged to share their resiliency success stories now. The Council has begun accepting award nominations beginning in September for the 2017 awards. To learn more about this prestigious award, visit here. Any member of the Global Supply Chain Resiliency Council LinkedIn group is eligible to nominate a company, educational organization, individual or team for consideration.

resilinc
POWERING THE RESILIENT SUPPLY CHAIN

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About Resilinc

Resilinc helps CEOs and Chief Supply Chain Officers consistently achieve their revenue goals despite supply chain disruptions worldwide. Resilinc's platform provides companies access to advanced multi-tier mapping and part origin intelligence, collected from over 35,000 suppliers across more than 65,000 factories globally. Industry leading companies like IBM, General Motors, EMC, Amgen and Western Digital rely on Resilinc's supplier intelligence repository, combined with analytics regarding vulnerabilities, risk scores and revenue impact to predict the critical failure points in their supply chain. This helps them to prioritize and proactively mitigate supply chain risks before they manifest into major problems. What's unique about Resilinc is the deep supply chain expertise of the team, the ability for customers to accelerate meeting their resiliency goals without hiring large teams or investing in IT projects by leveraging the full suite of supplier and customer facing services, gain high quality data from an ISO certified data operation and also gain tremendous benchmarking and help throughout their maturity journey. Resilinc is the solution of choice for Chief Procurement Officers who want to be in control of their supply chain and sleep better at night knowing they will be able to consistently meet their revenue goals without needing to hold extra inventory or pay expedited raw material or freight costs.

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