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Ascend Webinars

TRANSCRIPT: Supply Chain Resilience – ASQE Jan 2025 Ascend Webinar

1
00:00:02.240 --> 00:00:07.290
Brian Scarpace: Hello! Welcome, everybody! We'll just give it another minute here to let people in the room.

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00:00:25.460 --> 00:00:30.069
Brian Scarpace: If you just joined us, we're just giving everybody a chance to get into the room to

3
00:00:30.890 --> 00:00:33.370
Brian Scarpace: get settled and enjoy today's content.

4
00:01:01.540 --> 00:01:05.100
Brian Scarpace: Okay, welcome, everybody. I think we'll go ahead and get started.

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00:01:06.460 --> 00:01:18.899
Brian Scarpace: So hello, welcome to today's ASQE Ascend Webinar focused on Supply Chain Resilience. My name is Brian Scarpace, and I serve as the Executive Director of Global Success for ASQE, and we're glad you're joining us today.

6
00:01:18.900 --> 00:01:42.429
Brian Scarpace: I want to say, 1st of all, thank you to our Organizational Members who are joining us. Thank you so much for your membership, and I know we have some guests who might be joining us today, too. So welcome. We're looking forward to providing a lot of great content for you today. One item to note that these slides that for today will be available in our ASQE Events Portal. We'll put a link in the chat for that. And then post post-event, we'll have a email that goes out in about a day or so.

7
00:01:42.500 --> 00:01:50.040
Brian Scarpace: and that'll include a link to the recording. And the great thing about that is that you can share that with others on your team who may not have had a chance to join today.

8
00:01:52.130 --> 00:02:15.209
Brian Scarpace: So, a little bit about us, ASQExcellence, or ASQE. For short, we are an independent and complementary entity to ASQ, and our mission is to deliver credentialing, quality driven offerings, and insights to organizations in support of their performance excellence journey. And today's webinar is a great example of

the type of offering we make available to our organizational members and customers to provide insights and other value for them.

9
00:02:17.730 --> 00:02:34.250
Brian Scarpace: All right, I'm very excited to announce today's presenter, Mr. Russ Snyder. Russ is the founder of 6 Sigma Supply Chain Consulting, and CEO of Clear Blew. He retired as a Senior Director at the Intel Corporation, managing supply chain operations for 23 years.

10
00:02:34.810 --> 00:02:57.819
Brian Scarpace: Russ is a Registered Professional Engineer, MBA, and Lean and Six Sigma Greenbelt. He's also a frequent presenter at ASQ conferences. He's an ASQ Senior Member, and he's also the Chair-elect of the Electronics and Communication Division, and he also won the 2020 Lean Excellence Award from the USC Marshall School of Business. Welcome, Russ, we're excited to have you here. I'm going to hand it over to you.

11
00:03:04.910 --> 00:03:24.840
Russ Snyder: Thank you, Brian. We'll go ahead and dive right into the presentation today, and I've spoken a few times over the last few years on supply chain resilience. I developed a model a few years back, and I've been advancing that model. And today we'll talk about using it to manage your risk in supply chain.

12
00:03:25.470 --> 00:03:34.290
Russ Snyder: So today, our our learning objectives are, understand supply, chain business risk, develop a resilience score for each node on your supply network

13
00:03:34.810 --> 00:03:40.419
Russ Snyder: design and flexibility, balance, flexibility, and anticipate market turns.

14
00:03:40.750 --> 00:03:43.749
Russ Snyder: reduce risk and balance your supply chain.

15
00:03:49.150 --> 00:04:02.369
Russ Snyder: So let's get started with a few articles that I found that talk about the state of supply chain and how broken or healed it may be. The Economist Magazine, I really find, is

16
00:04:02.930 --> 00:04:09.070
Russ Snyder: done an interesting job at saying that we're probably not ever going to fix our supply chains.

17
00:04:10.790 --> 00:04:12.730
Russ Snyder: They report that

18
00:04:13.020 --> 00:04:21.120
Russ Snyder: that most of the precautions or the risk mitigations are more costly and too difficult to implement.

19
00:04:21.220 --> 00:04:26.839
Russ Snyder: They use a quote from Napoleon, and we know that his tenure didn't end very well.

20
00:04:27.250 --> 00:04:32.459
Russ Snyder: but his quote was, the torment of precautions often exceeds the dangers to be avoided.

21
00:04:32.710 --> 00:04:41.019
Russ Snyder: It's sometimes better to abandon oneself to destiny, meaning, don't do anything, move forward and let it go

22
00:04:41.150 --> 00:04:41.825
Russ Snyder: and

23
00:04:43.090 --> 00:04:53.160
Russ Snyder: I'm going to try to convince you today that there are things you can do that don't require a lot of cost to at least understand your risk, and then take take steps to manage it.

24
00:04:54.260 --> 00:05:01.430
Russ Snyder: The Harvard Business Review shares with us. That supply chain disruption isn't the only problem

25
00:05:02.430 --> 00:05:05.339
Russ Snyder: supply chain often is a feast and famine

26
00:05:06.050 --> 00:05:14.629
Russ Snyder: system where you have excesses, and then you have shortages, and it flips back and forth. And

27
00:05:14.760 --> 00:05:20.499
Russ Snyder: you know, the last year they published that the next supply chain challenge isn't a shortage. It's an inventory glut.

28
00:05:20.860 --> 00:05:24.500
Russ Snyder: I'll share with you later that in the semiconductor space, that's true.

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00:05:26.820 --> 00:05:40.240
Russ Snyder: And then Forbes finally, they did an article about broken supply chains. Are they really broken? And this was 3 years after the pandemic began, and some industries were still experiencing shortages.

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00:05:41.000 --> 00:05:53.799
Russ Snyder: And so, I what I think is, you know, supply chain. It can pick and choose which industries it has issues, demand comes and goes.

31
00:05:53.950 --> 00:05:58.520
Russ Snyder: customers hoard products, causing

32
00:05:58.660 --> 00:06:04.129
Russ Snyder: the flip side. Where then there's excess inventory. When they quit buying for quite a period of time.

33
00:06:04.270 --> 00:06:08.429
Russ Snyder: and we'll move. Go ahead and move to the next one to define some business risk.

34
00:06:08.590 --> 00:06:14.869
Russ Snyder: ISO 9001 defines risk as the effect of uncertainty on an expected result.

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00:06:18.000 --> 00:06:31.320
Russ Snyder: and it goes on to say it can be positive or negative, and you know a lot of times in supply chain. We'll see that we have a shortage which is a negative, and then we have an excess which is positive.

36
00:06:32.130 --> 00:06:37.369
Russ Snyder: neither one or what we want. We want to remain in steady state the whole time. Where we have

37
00:06:37.620 --> 00:06:40.540
Russ Snyder: supply and demand balanced.

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00:06:41.100 --> 00:06:51.909
Russ Snyder: McKinsey is also a big on risk management, and they say business risk is exposure to a situation that can lead to decreased profits or bankruptcy.

39
00:06:52.260 --> 00:06:55.113
Russ Snyder: I think we've seen that in the pandemic

40
00:06:55.920 --> 00:07:03.119
Russ Snyder: they include specifically supply chain disruptions as one of those events that can put your business at risk.

41
00:07:04.950 --> 00:07:11.549
Russ Snyder: Let's define resilience in a few different terms, the capacity to withstand and recover from a disruption.

42
00:07:12.320 --> 00:07:25.840
Russ Snyder: And we'll go a little bit towards a systems engineering approach. And we'll look at response time of a system and response. Time is in engineering terms. The time it takes for a system to return back to steady state.

43
00:07:25.980 --> 00:07:31.349
Russ Snyder: and that can be from a negative or a positive

44
00:07:33.249 --> 00:07:46.280
Russ Snyder: stimulation to the system. And that means, you know, we could have a shortage, and we could have an excess, but we would prefer to have neither of those, and have any one of those as short a time as we can possibly manage it.

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00:07:47.090 --> 00:07:54.900
Russ Snyder: Factors to calculate a resilience, score time to return to steady state and lost revenue risk as a percentage of revenue.

46
00:07:55.300 --> 00:08:05.099
Russ Snyder: Now, you can imagine that you have to may have to have a lot of inputs to be able to determine that time to return to steady state. But that's what I want to show you in my model

47
00:08:09.380 --> 00:08:17.939
Russ Snyder: some of the probable disruptions from published also from McKinsey in their risk, resilience, and rebalancing in global supply chain

48
00:08:18.130 --> 00:08:19.410
Russ Snyder: document.

49
00:08:20.210 --> 00:08:22.929
Russ Snyder: And if you look at the table on the right.

50
00:08:23.110 --> 00:08:33.330
Russ Snyder: It talks about various different catastrophes and disruptions, anything from a meteoroid strike to an acute climatological event

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00:08:33.799 --> 00:08:43.000
Russ Snyder: and everything in between, but what they do define it, as each of these has a fixed duration of the event that's going to be a disruption

52
00:08:43.270 --> 00:08:47.000
Russ Snyder: anywhere from one to 2 weeks to 2 plus months.

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00:08:47.110 --> 00:08:57.740
Russ Snyder: And what I think about these types of disruptions are that many of these outages for a short duration can be managed through inventory alone

54
00:08:58.040 --> 00:09:00.329
Russ Snyder: and different inventory levels.

55
00:09:01.250 --> 00:09:04.800
Russ Snyder: But in my experience in the semiconductor industry

56
00:09:05.430 --> 00:09:21.760
Russ Snyder: we have a global or industry. Wide event happen about every 7 to 10 years, and you know it could be an enormous demand change such as around the year 2K event, or it could be a pandemic which drives demand for

57
00:09:22.120 --> 00:09:26.500
Russ Snyder: laptops for working from home to extreme levels.

58
00:09:28.310 --> 00:09:35.580
Russ Snyder: But more frequently we have single supplier events that occur about every 3 years, and this can be everything from

59
00:09:35.960 --> 00:09:41.909
Russ Snyder: a supplier who has a factory fire, and that factory is incapable of producing for over a year.

60
00:09:42.777 --> 00:09:43.910
Russ Snyder: It could be

61
00:09:44.710 --> 00:09:53.579
Russ Snyder: suppliers who have oversold their capacity, and cannot solve that problem because it takes a long time to add capacity.

62
00:09:53.830 --> 00:10:02.300
Russ Snyder: and these occur about every 3 years, when, in fact, we had 2 different suppliers with factory fires that took their production down for over a year.

63
00:10:03.710 --> 00:10:11.230
Russ Snyder: and many events aren't this short in duration? And they last for a year or more of limited output. And I'll go into that a little more later.

64
00:10:12.870 --> 00:10:22.410
Russ Snyder: Let's talk about some probable uncertainties, and these are a lot more common factors impacting resilience, and these occur on the more frequent every 3 year. Basis.

65
00:10:23.430 --> 00:10:29.889
Russ Snyder: Unplanned upsides or downsides in demand. A product could be more popular than anyone forecast.

66
00:10:30.660 --> 00:10:39.919
Russ Snyder: It could be a situation where customers are hoarding the product, and at some point the demand is going to evaporate because they have too much.

67
00:10:40.370 --> 00:10:46.549
Russ Snyder: The product loses competitive edge and could be unforecast downsides in demand.

68
00:10:48.400 --> 00:11:03.790
Russ Snyder: Couple of the most frequent issues we've had are suppliers who sell out their capacity and limit our shipments, and didn't notify us of the coming shortages, or we forecast something that was far too low than that they planned for.

69
00:11:04.650 --> 00:11:10.510
Russ Snyder: And then, lastly, a protracted yield or quality issue can also cause a long term

70
00:11:11.340 --> 00:11:14.419
Russ Snyder: inability to to meet your total demand.

71
00:11:18.030 --> 00:11:26.900
Russ Snyder: Now, key factors in resilience, and I'll talk about this in a couple of different ways as we go through the slides. The 1st one is capacity buffers.

72
00:11:28.820 --> 00:11:36.839
Russ Snyder: and you know every pol. Every corporation has its own policy on capacity. And how much buffer you'll keep?

73
00:11:37.250 --> 00:11:42.550
Russ Snyder: Is it a reward for max profitability to drive high utilization?

74
00:11:42.700 --> 00:11:50.290
Russ Snyder: Or is there some amount of resilience planning that allows for fluctuations in demand and the ability to handle it.

75
00:11:51.190 --> 00:12:00.379
Russ Snyder: Similarly, not only your internal capacity, but your suppliers, buffer capacity, and inventory levels, should be known and monitored by the customer.

76
00:12:00.890 --> 00:12:09.270
Russ Snyder: And what what I find is that even in our situation many times we did not know our capacity.

77
00:12:10.020 --> 00:12:12.700
Russ Snyder: our capacity forecast from our suppliers.

78
00:12:15.570 --> 00:12:20.699
Russ Snyder: We don't have a mandatory requirement for suppliers or report capacity buffers or

79
00:12:21.330 --> 00:12:27.140
Russ Snyder: or their capacity forecast. We do ping them every once in a while to understand that. But

80
00:12:27.855 --> 00:12:39.850
Russ Snyder: after living through the pandemic, I believe that suppliers should automatically report capacity and tight capacities on a monthly or quarterly basis.

81
00:12:40.750 --> 00:12:46.099
Russ Snyder: inventory buffers mitigate near-term demand uncertainty and most disruptions.

82
00:12:46.230 --> 00:12:50.949
Russ Snyder: But it doesn't mitigate long-term sustained disruptions.

83
00:12:51.390 --> 00:12:53.460
Russ Snyder: And lastly, multi-sourcing.

84
00:12:53.850 --> 00:12:54.690
Russ Snyder: And

85
00:12:55.140 --> 00:13:09.570
Russ Snyder: simply I just say good suppliers. Have bad days, you know. I mentioned that about every 3 years we had a big, supplier incident, 2 of those being factory fires, and they were good suppliers, and they just could not deliver to us

86
00:13:12.320 --> 00:13:22.819
Russ Snyder: a little bit of a side note here on resilience just in time and lean, and why they're changing to make supply lines more resilient.

87
00:13:23.030 --> 00:13:28.100
Russ Snyder: My 1st article is from Reuters how Toyota thrives when the chips are down.

88
00:13:29.120 --> 00:13:32.529
Russ Snyder: and it goes on to say that from the Fukushima earthquake.

89
00:13:32.740 --> 00:13:39.679
Russ Snyder: Toyota had significant supply disruptions, and from that they changed their business continuity, planning

90
00:13:40.010 --> 00:13:46.490
Russ Snyder: to increase inventories for things like semiconductors and other long lead time items.

91
00:13:47.790 --> 00:14:03.100
Russ Snyder: And I think you'll note in the article that talks about from 2 to 6 months worth worth of inventory, and you know, just to to compare that to days. We do days of inventory that's 60 to 180 days of inventory, and that'll come in.

92
00:14:03.230 --> 00:14:06.000
Russ Snyder: Come into play when we start working on the model.

93
00:14:06.950 --> 00:14:15.839
Russ Snyder: The Journal of Lean Six Sigma had a paper presented, published, called "Lean, Agile Resilience, and Green Divergences and Synergies,"

94
00:14:16.250 --> 00:14:27.570
Russ Snyder: and what I'll show you is that 2 of the areas for resilience were capacity surplus and inventory levels. 2 of the 2 of the 3 things that I believe you need for resilience.

95
00:14:28.060 --> 00:14:36.749
Russ Snyder: and you'll notice that resilience requires increased capacity, surplus and inventory levels.

96
00:14:36.910 --> 00:14:44.869
Russ Snyder: And you look at the lean column and lean is trying to reduce inventories and reduce capacity surplus.

97
00:14:46.010 --> 00:14:48.709
Russ Snyder: So what? What I believe

98
00:14:49.790 --> 00:15:01.129
Russ Snyder: what I believe is that lean essentially works against the physics of supply chain that require a certain amount of slack to be successful through disruptive events.

99
00:15:03.740 --> 00:15:06.990
Russ Snyder: Now we'll explain the model and how to set up the model.

100
00:15:07.870 --> 00:15:14.529
Russ Snyder: And if you look at the the 1st 4 lines on my spreadsheet.

101
00:15:15.510 --> 00:15:24.890
Russ Snyder: their lead time, capacity, buffer percentage, number of sources and inventory. These are the primary inputs required to

102
00:15:25.140 --> 00:15:31.100
Russ Snyder: be able to give and take and make trade-offs on how quickly

103
00:15:31.320 --> 00:15:37.610
Russ Snyder: your supply chain will return to steady state across the top.

104
00:15:40.350 --> 00:15:53.180
Russ Snyder: across the top, show you the supply chain. The green dots are inventory locations, and the others are actually manufacturing stops on the supply chain. So, you see that we have 4 wafer Fab

105
00:15:53.280 --> 00:16:00.990
Russ Snyder: assembly test and board manufacturing. And this is true for almost every electronic supply chain

106
00:16:02.570 --> 00:16:13.320
Russ Snyder: and the model here I've already put in a disruption, and I'll show you how that that computes a resilience factor for each one of these different manufacturing sites on our

107
00:16:13.470 --> 00:16:14.870
Russ Snyder: on our supply chain.

108
00:16:15.570 --> 00:16:25.560
Russ Snyder: So the Fab, you see, lead time is 77 weeks and 77 is the number it takes to add capacity once capacity has filled up.

109
00:16:25.990 --> 00:16:42.520
Russ Snyder: and that's quite a long lead time, and what you'll see is with a with a buffer of a buffer capacity of minus 20% meaning. You're only going to get 80% of what you order. You have a single source, only 21 days of inventory.

110
00:16:42.900 --> 00:16:49.490
Russ Snyder: then the revenue risk with this disruption is 362 million dollars.

111
00:16:49.840 --> 00:16:53.619
Russ Snyder: and the resilience factor calculated is 0 point 9.

112
00:16:54.170 --> 00:17:00.150
Russ Snyder: Now let's talk about what the resilience factor means. 0 is the lowest possible resilience.

113
00:17:00.430 --> 00:17:06.710
Russ Snyder: and 10 is the highest resilience, meaning you will miss 0 shipments and 0 revenue.

114
00:17:10.250 --> 00:17:19.670
Russ Snyder: So, the disruption that we're modeling here is a 30% increase in demand, a 20% loss of capacity and a 7 day outage.

115
00:17:20.990 --> 00:17:28.590
Russ Snyder: and if you look at assembly where the lead time to get new capacity is only 17 weeks.

116
00:17:28.720 --> 00:17:34.409
Russ Snyder: then our resilience factor is all the way up to 8.4,

117
00:17:35.100 --> 00:17:37.420
Russ Snyder: and you look at board manufacturing

118
00:17:38.280 --> 00:17:44.410
Russ Snyder: with only a 13 week time to add capacity. We're at a resilience factor of 9

119
00:17:45.770 --> 00:18:00.559
Russ Snyder: now. The resilience factor is a it's a relative measure of of how resilient am I? And that's a factor of how long it takes to recover, and how much revenue loss I'm going to have during that period of time.

120
00:18:01.020 --> 00:18:09.400
Russ Snyder: And you see that even with a 9.0 resilience factor, we still had 42 million dollars of revenue lost.

121
00:18:09.840 --> 00:18:17.490
Russ Snyder: But that's only 4.2% of total revenue, which is a risk.

122
00:18:18.400 --> 00:18:21.910
Russ Snyder: worth taking to some not worth taking to others.

123
00:18:26.590 --> 00:18:27.450
Russ Snyder: Okay.

124
00:18:28.040 --> 00:18:38.690
Russ Snyder: we're going to go through a few examples of different one different of our manufacturing sites on the network, and how you can model different ways to manage your risk.

125
00:18:39.330 --> 00:18:48.870
Russ Snyder: and with a mix of capacity, multi sources, and inventory. And it'll compute a different resilience factor based on

126
00:18:49.090 --> 00:18:58.700
Russ Snyder: these different methods of mitigating your risk, and it allows you to make trade-offs. You don't have to put it all in inventory. You can have capacity buffers.

127
00:18:59.510 --> 00:19:05.959
Russ Snyder: and what this does is, it'll allow you to cost out what

128
00:19:06.070 --> 00:19:13.359
Russ Snyder: mitigations you might be taking. Based on the different different resilience factors.

129
00:19:13.760 --> 00:19:19.488
Russ Snyder: All right. So, the lead time for new capacity to Fab is 77 weeks.

130
00:19:20.940 --> 00:19:27.859
Russ Snyder: and we're going to use the same disruption, 30% upside in demand, minus 20% capacity, loss.

131
00:19:28.000 --> 00:19:30.850
Russ Snyder: and an outage duration of 7 days.

132
00:19:31.890 --> 00:19:37.620
Russ Snyder: So, the 1st column is the disruption that I showed you before with a point 9 resilience factor.

133
00:19:37.890 --> 00:19:53.540
Russ Snyder: If we just change inventory levels to 180 days, like Toyota did for their semiconductors. We dramatically increase our resilience, and we dramatically reduce our risk just by adding inventory.

134
00:19:53.910 --> 00:20:00.169
Russ Snyder: and you can see that we reduce our revenue risk from 362 million to 90 million dollars.

135
00:20:01.350 --> 00:20:05.940
Russ Snyder: Now, if we continue to add a second source

136
00:20:06.170 --> 00:20:19.700
Russ Snyder: and capacity buffer. In the second source we can significantly lower inventory days in the 3rd column to 94.5, and our resilience factor is the same 7.7 5.

137
00:20:20.630 --> 00:20:26.439
Russ Snyder: If you want to make your resilience so that you will lose no revenue based on this particular disruption.

138
00:20:26.700 --> 00:20:30.249
Russ Snyder: you can add a 30% buffer at your second source.

139
00:20:30.610 --> 00:20:35.730
Russ Snyder: 126 days of inventory, and you will miss no revenue.

140
00:20:36.380 --> 00:20:38.090
Russ Snyder: Take no risk.

141
00:20:39.140 --> 00:20:45.009
Russ Snyder: I pretty much am not an advocate that you should mitigate a hundred percent of your disruption.

142
00:20:45.260 --> 00:20:49.390
Russ Snyder: You should balance that, and we'll talk about balancing later.

143
00:20:49.900 --> 00:21:05.090
Russ Snyder: All right, let's look at board manufacturing and the same disruption, and let's move from left to right. And if you look at just adding inventory of 45 to 45 days. You see that we increase the resilience to 10,

144
00:21:05.820 --> 00:21:07.590
Russ Snyder: meaning no revenue lost.

145
00:21:07.830 --> 00:21:13.890
Russ Snyder: We can reduce the inventory in the next column by adding a second source with a 20% buffer capacity.

146
00:21:14.180 --> 00:21:15.879
Russ Snyder: And in the 3rd column

147
00:21:16.310 --> 00:21:22.609
Russ Snyder: we can add a 30% buffer capacity to our second source, and only 24 days of inventory.

148
00:21:22.870 --> 00:21:28.399
Russ Snyder: So, you see that there are multiple ways to achieve low risk in your supply chain.

149
00:21:28.580 --> 00:21:31.489
Russ Snyder: Balancing these 3 inputs.

150
00:21:33.210 --> 00:21:39.530
Russ Snyder: The key takeaway. Here is the shorter the lead time, the higher the resilience and the mitigation is more flexible.

151
00:21:43.020 --> 00:21:55.970
Russ Snyder: Let's go back to Fab, and we're going to look at pandemic conditions. We're going to model the pandemic what really went on. And our experience through the pandemic and wafer Fab was one of our big

152
00:21:57.330 --> 00:22:02.670
Russ Snyder: constraints that we had to deal with, and our primary Fab

153
00:22:02.960 --> 00:22:07.430
Russ Snyder: reduced our output that we were requesting by 40%.

154
00:22:07.570 --> 00:22:13.049
Russ Snyder: And they really didn't give us a lot of lead time. We had. Like 4 months of lead time.

155
00:22:13.820 --> 00:22:18.350
Russ Snyder: We had a single source. We carried a typical 21 days of inventory.

156
00:22:19.150 --> 00:22:27.469
Russ Snyder: and that revenue risk, had we not done anything would have been 652 million dollars, or

157
00:22:27.670 --> 00:22:29.990
Russ Snyder: almost 2 thirds of our revenue.

158
00:22:31.070 --> 00:22:32.190
Russ Snyder: So,

159
00:22:33.180 --> 00:22:40.089
Russ Snyder: so what did we do? We had actually taped out a part to a second Fab who had the same process.

160
00:22:40.340 --> 00:22:47.390
Russ Snyder: and we did an emergency qualification of that Fab to add capacity.

161
00:22:47.610 --> 00:22:53.470
Russ Snyder: But if we were going to model this disruption and decide how many, how much.

162
00:22:53.660 --> 00:23:02.240
Russ Snyder: how much inventory would it take to get to a resilience factor, and I've used 7.7 5 in the previous example. I use it here, too.

163
00:23:02.460 --> 00:23:05.579
Russ Snyder: It would take 302 days of inventory.

164
00:23:06.326 --> 00:23:09.170
Russ Snyder: To basically get to the same resilience

165
00:23:09.330 --> 00:23:12.389
Russ Snyder: that we had in the previous model.

166
00:23:14.030 --> 00:23:26.670
Russ Snyder: If we add the second Fab and the second Fab actually has 0 buffer capacity, but has we can allocate 50% to them that we only need to keep 250 days of inventory.

167
00:23:27.560 --> 00:23:29.910
Russ Snyder: It gives us the same resilience factor.

168
00:23:30.540 --> 00:23:41.859
Russ Snyder: If we actually have 10% buffer at our second source, then we can bring our we can manage with 276 days of inventory to get to

169
00:23:41.970 --> 00:23:46.110
Russ Snyder: no risk a 0-revenue risk option.

170
00:23:47.680 --> 00:23:52.590
Russ Snyder: What I'll say here is the prevention cost is far less than the revenue loss.

171
00:23:53.314 --> 00:23:57.540
Russ Snyder: Opportunity. And I think that you see that you know when

172
00:23:58.480 --> 00:24:05.370
Russ Snyder: you know automakers struggle to get semiconductors, you can see that the revenue risk would be quite large.

173
00:24:07.900 --> 00:24:16.070
Russ Snyder: All right, let's look at board manufacturing, which has a much shorter lead time to add capacity. What will we do in pandemic conditions.

174
00:24:16.555 --> 00:24:29.339
Russ Snyder: Again, the demand is up 50%. The capacity buffers are 0. And then at the board factory we actually had an outage for 35 days at both suppliers. We had 2 suppliers to begin with.

175
00:24:29.550 --> 00:24:33.720
Russ Snyder: and we're so we're going to model the actual, the actual issue here.

176
00:24:34.060 --> 00:24:37.999
Russ Snyder: And you see that with our with our

177
00:24:38.410 --> 00:24:44.390
Russ Snyder: our normal mitigation of capacity buffer of 20%, a number of sources.

178
00:24:44.550 --> 00:24:47.259
Russ Snyder: 1, 21 days of inventory.

179
00:24:47.520 --> 00:24:50.349
Russ Snyder: our revenue risk would still only be

180
00:24:51.500 --> 00:24:54.520
Russ Snyder: $83 thousand, $83 million dollars.

181
00:24:55.060 --> 00:25:04.240
Russ Snyder: and that's pretty resilient because it takes such a short time to add capacity. And you have buffer to catch up when you come back online.

182
00:25:05.130 --> 00:25:13.029
Russ Snyder: If you wanted to take 0 risk, there's many, many different options to balance 0 risk. If we had one source, 20% buffer.

183
00:25:14.060 --> 00:25:18.249
Russ Snyder: and we would need 79 days of inventory.

184
00:25:18.630 --> 00:25:28.170
Russ Snyder: And if you go to the far right, if we had 30% buffer capacity with 2 suppliers. We'd only need 47 days of inventory to to have no revenue risk.

185
00:25:30.350 --> 00:25:40.319
Russ Snyder: Now, I modeled a 50% upside in demand. But in reality, in 2020, we actually had a 70% upside in in orders.

186
00:25:40.450 --> 00:25:49.105
Russ Snyder: and we made it the real fab capacity. Constraint happened in 2021 and

187
00:25:50.160 --> 00:25:53.359
Russ Snyder: and that's when we had to get the second source online.

188
00:25:53.890 --> 00:26:00.530
Russ Snyder: But our mitigation with 2 sources and capacity Buffer held up pretty well, even though we didn't have

189
00:26:00.820 --> 00:26:04.829
Russ Snyder: the 79 days or the 47 days of inventory.

190
00:26:09.660 --> 00:26:10.510
Russ Snyder: okay.

191
00:26:11.590 --> 00:26:25.690
Russ Snyder: let's talk about the summary and the things that the model gives you the opportunity to make business decisions and management decisions. For one is anticipate the model forecast, the impact of a disruption

192
00:26:26.500 --> 00:26:29.819
Russ Snyder: of each note of your value chain before it happens.

193
00:26:30.180 --> 00:26:35.100
Russ Snyder: the resilience factor provides a normalized impact to your business for each node.

194
00:26:35.320 --> 00:26:39.580
Russ Snyder: So, if you're planning to mitigate risks, you can say, Okay.

195
00:26:39.700 --> 00:26:50.239
Russ Snyder: I want to manage my risk to a 7.5 resilience factor. We know you're not mitigating all risk, but you're mitigating some risk.

196
00:26:53.050 --> 00:26:54.955
Russ Snyder: It's a huge

197
00:26:56.340 --> 00:26:59.080
Russ Snyder: It's a huge tool to calculate

198
00:26:59.698 --> 00:27:03.910
Russ Snyder: your to to help prepare your business continuity plan.

199
00:27:04.060 --> 00:27:21.740
Russ Snyder: If you actually model what's going to happen, it's much easier to put together a business continuity plan, regardless. If it's a an earthquake or a geopolitical event, you you don't model an event, you model. How much outage am I going to have.

200
00:27:23.090 --> 00:27:26.569
Russ Snyder: or how much loss of capacity am I going to have?

201
00:27:27.350 --> 00:27:31.150
Russ Snyder: It provides a measure of risk for each node of your value chain.

202
00:27:32.650 --> 00:27:36.319
Russ Snyder: It also allows you to make trade-offs in cost and risk.

203
00:27:36.460 --> 00:27:44.700
Russ Snyder: And what I, what I shared with you is a balance of risk mitigations between inventory capacity, buffer, and number of sources.

204
00:27:45.280 --> 00:27:49.510
Russ Snyder: you can evaluate the cost of mitigation versus the lost revenue.

205
00:27:53.300 --> 00:28:00.809
Russ Snyder: Now you see this lady in this picture, she's looking fairly horrified at what she's seeing the problem with

206
00:28:01.400 --> 00:28:11.290
Russ Snyder: with risk, mitigation, and adding capacity buffers is, there's always a downside of resilience, and that's when demand drops.

207
00:28:11.600 --> 00:28:20.409
Russ Snyder: And if and similar to what happened in the pandemic demand, skyrocketed for certain things, for through 2021,

208
00:28:20.680 --> 00:28:28.789
Russ Snyder: and then in 2022 demand evaporated, and we're left with a lot of excess capacity. A lot of inventory

209
00:28:30.200 --> 00:28:38.910
Russ Snyder: so demand drop in cyclical or disrupted industries can take our supply chains again out of steady state, leaving us with excess, capacity, and inventory.

210
00:28:39.070 --> 00:28:53.730
Russ Snyder: Preparing for this inevitability requires different modeling and response. It also requires understanding, customer behavior and industry macro indicators. And what I'll share with you is a little bit of how we take a look at these things.

211
00:28:55.350 --> 00:29:04.870
Russ Snyder: So the resilience model also has a parallel model that allow you to take your your mitigation

212
00:29:05.120 --> 00:29:17.550
Russ Snyder: and then apply a 30% downside, or whatever demand. Drop that you want to understand what the implications are to your supply chain and inventory and capacity surplus.

213
00:29:18.680 --> 00:29:19.580
Russ Snyder: Excuse me.

214
00:29:24.540 --> 00:29:34.669
Russ Snyder: So, you see that we need to, we need to add something called cancellation days. How long will it be till I'm I don't have to take the material that I've ordered

215
00:29:36.968 --> 00:29:42.449
Russ Snyder: inventory levels that you've calculated for to manage your disruption.

216
00:29:42.870 --> 00:29:45.890
Russ Snyder: and then we'll take a 30% demand drop.

217
00:29:46.050 --> 00:29:55.879
Russ Snyder: In this particular case. You know, we have inventory excess risk at different levels based on the different inventory levels that we've we've chosen.

218
00:29:56.120 --> 00:30:02.420
Russ Snyder: and you see that it ranges anywhere from 41 million dollars to $68 million dollars.

219
00:30:03.790 --> 00:30:11.199
Russ Snyder: It gives you an excess capacity, calculation, and it also gives you a number, a ratio called profit to excess.

220
00:30:11.500 --> 00:30:16.420
Russ Snyder: and how I came up with this is, what is a reasonable

221
00:30:17.030 --> 00:30:23.320
Russ Snyder: amount of risk to take, and what is a reasonable cost to spend to mitigate risk given that

222
00:30:23.550 --> 00:30:26.430
Russ Snyder: we know demand will go away someday.

223
00:30:27.890 --> 00:30:39.890
Russ Snyder: and I pretty much looked at a ratio of 1.0 as the break-even point. For how much risk that we should take in our particular business.

224
00:30:40.370 --> 00:30:51.959
Russ Snyder: it can be a different level, decided by management, on how much, how much risk you want to take and how much excess you're willing to accept. If demand does go away.

225
00:30:52.210 --> 00:31:03.840
Russ Snyder: different industries have different levels of demand fluctuation. And I'm not going to say that I know for every industry what that will be, but the model will allow you to predict what is appropriate for your industry.

226
00:31:04.730 --> 00:31:14.740
Russ Snyder: So, if we chose to a profit excess level of 1 point, oh, then that would deem our model would be 51 days of inventory and a 20% capacity buffer.

227
00:31:16.100 --> 00:31:19.099
Russ Snyder: and that would give us a a resilience factor of 10.

228
00:31:19.660 --> 00:31:26.560
Russ Snyder: But a fully balanced strategy requires balancing the time it takes to return to steady state with a drop in demand.

229
00:31:29.210 --> 00:31:36.650
Russ Snyder: And lastly, your resilience factor target should be proportionate to product margin and economic to make economic sense.

230
00:31:36.990 --> 00:31:51.530
Russ Snyder: So, I call this this next slide quintessential supply chain policy. Damned if you do, and damned if you don't, because if you don't plan for the risk. It's going to happen. And if you do plan for the risk, you're going to have excess, and that's why you have to balance.

231
00:31:52.250 --> 00:32:03.009
Russ Snyder: but the model allows you to know your risk, and you can take all the risk you want. But this way you're at least taking conscious risk, instead of unconscious risk.

232
00:32:03.280 --> 00:32:07.480
Russ Snyder: the resilience factor guides you with a risk level for the model disruption.

233
00:32:08.510 --> 00:32:21.540
Russ Snyder: And then, when you start to think about resilience policy, I believe that resilience policy should be more than just in the supply chain organization. It should be a business decision across management.

234
00:32:22.400 --> 00:32:25.469
Russ Snyder: and there you have to balance business priorities.

235
00:32:26.180 --> 00:32:30.680
Russ Snyder: What's most important to your organization? Is it order, fulfillment percent?

236
00:32:30.910 --> 00:32:35.430
Russ Snyder: Is it customer satisfaction? Is it profitability?

237
00:32:36.010 --> 00:32:47.860
Russ Snyder: Is it minimizing inventory or optimizing factory utilization? All these things work against each other. And

238
00:32:48.391 --> 00:32:53.529
Russ Snyder: that's why you need to make some decisions on how much risk you're willing to take

239
00:32:53.680 --> 00:32:56.590
Russ Snyder: to be able to balance these different things.

240
00:32:57.770 --> 00:32:59.559
Russ Snyder: So, let's find the balance.

241
00:32:59.680 --> 00:33:04.770
Russ Snyder: Set a resilience strategy to align with your business priorities.

242
00:33:05.510 --> 00:33:09.519
Russ Snyder: The resilience factor provides a quantifiable target for risk

243
00:33:09.970 --> 00:33:16.349
Russ Snyder: with a normalized value that you can use across any supplier, any part of the value chain.

244
00:33:16.690 --> 00:33:22.000
Russ Snyder: The profit excess ratio provides a financial metric on how much insurance you can afford.

245
00:33:25.430 --> 00:33:35.870
Russ Snyder: So, this slide it talks about the macro trends in your industry, and I alluded to one article from Hbr at the beginning that talked about. The next problem is inventory. Glut!

246
00:33:37.170 --> 00:33:39.839
Russ Snyder: Well, if you look at the dark blue line

247
00:33:40.250 --> 00:33:52.390
Russ Snyder: and I show in the timeline where the pandemic begins, inventories begin to rise, and where the pandemic ends as far as a supply demand crisis.

248
00:33:54.690 --> 00:34:03.949
Russ Snyder: if you look at the date where inventories begin to rise, you're going to see the the blue line start to rise and continue to stay high.

249
00:34:04.200 --> 00:34:11.609
Russ Snyder: And today, even today the inventory levels have not returned to steady state. They're still about 20% above

250
00:34:11.929 --> 00:34:14.539
Russ Snyder: pre-pandemic inventory levels.

251
00:34:15.949 --> 00:34:25.259
Russ Snyder: And that's that's certainly not healthy. And that's because of all the over ordering and hoarding that went on in the entire supply chain from the customer on back.

252
00:34:26.710 --> 00:34:36.070
Russ Snyder: There are a few things you can look at, and these these macro industry indicators come from the Federal Reserve data collection system.

253
00:34:36.360 --> 00:34:41.380
Russ Snyder: Everybody has access to it. It's free data. It tells you what's going on in your industry.

254
00:34:41.670 --> 00:34:48.170
Russ Snyder: There's another. There's another couple of lines. The green line and the red line show a spike.

255
00:34:48.520 --> 00:34:55.279
Russ Snyder: and that's capacity utilization in the industry for semiconductors. They show a spike

256
00:34:55.610 --> 00:35:07.800
Russ Snyder: right when inventories begin to rise, and then they taper off, and those capacity utilization numbers continue to fall. From about May of 2021

257
00:35:08.520 --> 00:35:12.749
Russ Snyder: inventories began to rise approximately May of 2021.

258
00:35:13.420 --> 00:35:29.779
Russ Snyder: So, why I share this with you is we did not see ordering slow down at all for the second half of 2021, and we and the supply chain continued to deliver it extraordinary levels through the end of 2021,

259
00:35:30.030 --> 00:35:35.979
Russ Snyder: even though the industry had already caught up with demand and was exceeding demand with our supply.

260
00:35:37.960 --> 00:35:38.940
Russ Snyder: So,

261
00:35:39.420 --> 00:35:54.250
Russ Snyder: if you're looking at managing risk and mitigating risk, these industry-wide indicators are available, and they really do tell a story. Had we started paring back our inventory targets that we had increased during the pandemic.

262
00:35:54.810 --> 00:36:07.869
Russ Snyder: even if it's not May of '21, even if it's August of '21, we would have had much less excess inventory when it when the cliff really came in in January of of 2022.

263
00:36:10.480 --> 00:36:15.599
Russ Snyder: So again, we haven't returned to steady state in the semiconductor industry, and it's been

264
00:36:15.890 --> 00:36:21.560
Russ Snyder: what 4, 4, 5 years now since the pandemic began.

265
00:36:22.590 --> 00:36:32.170
Russ Snyder: Now, when downsides are more probable, and this is something you can learn from the historic macro indicators. Here

266
00:36:32.420 --> 00:36:43.489
Russ Snyder: you can be on guard for hoarding and try to read into what the customer orders are doing and what the industry inventory levels are doing and the industry capacity indicators are doing.

267
00:36:43.760 --> 00:36:49.020
Russ Snyder: Pare back inventory buffers, judge down customer demand with new product starts.

268
00:36:52.000 --> 00:36:58.209
Russ Snyder: So, the the entire electronic sector is is really had a real problem with inventory levels.

269
00:36:58.410 --> 00:37:02.129
Russ Snyder: And I think they were avoidable.

270
00:37:02.420 --> 00:37:07.350
Russ Snyder: I think that managing through the pandemic was doable

271
00:37:07.760 --> 00:37:15.739
Russ Snyder: with the right risk mitigations, and that we didn't have to end with as much excess as is in the system today.

272
00:37:16.330 --> 00:37:19.659
Russ Snyder: So, let's go back to the 1st question. Was Napoleon right?

273
00:37:20.530 --> 00:37:25.549
Russ Snyder: I say no. The torment of precautions do not exceed the danger to be avoided.

274
00:37:26.250 --> 00:37:30.039
Russ Snyder: The amount of effort it takes to simulate risk is pretty low

275
00:37:31.191 --> 00:37:37.089
Russ Snyder: the. The thing that you may not have is supplier capacity data.

276
00:37:37.530 --> 00:37:40.559
Russ Snyder: But you have. Probably the other levels of data

277
00:37:42.140 --> 00:37:49.100
Russ Snyder: understanding risk through simulation is a low-cost way to assess risk providing an easy path to mitigation.

278
00:37:49.750 --> 00:37:55.730
Russ Snyder: Mitigations can be costly and must be balanced with profitability and the state of the ecosystem.

279
00:37:57.660 --> 00:38:02.820
Russ Snyder: So, was The Economist Magazine right that we're really not going to fix supply chains.

280
00:38:03.930 --> 00:38:09.290
Russ Snyder: I fear that we won't learn from the biggest supply chain. Learning opportunity of our lifetime.

281
00:38:09.660 --> 00:38:16.160
Russ Snyder: I have had a few consulting events where

282
00:38:16.560 --> 00:38:20.509
Russ Snyder: the customer really did not want to

283
00:38:21.660 --> 00:38:28.730
Russ Snyder: fully manage the risk and balance the system. They were really more interested in understanding.

284
00:38:29.256 --> 00:38:34.309
Russ Snyder: How can I chase parts better when we do have an issue and be reactive.

285
00:38:35.010 --> 00:38:40.019
Russ Snyder: And how can I get faster information from my suppliers when I have a disruption

286
00:38:40.250 --> 00:38:43.459
Russ Snyder: and supply chain really doesn't move that fast

287
00:38:44.084 --> 00:38:49.699
Russ Snyder: knowing that data is important and being able to react to a situation is important.

288
00:38:49.840 --> 00:38:57.399
Russ Snyder: But planning and mitigating before an event happens, is far more successful. And I think.

289
00:38:57.967 --> 00:39:03.519
Russ Snyder: you know, our results during the pandemic showed that we had done a good amount of planning ahead of time.

290
00:39:03.640 --> 00:39:08.500
Russ Snyder: We didn't do a hundred percent of planning, and we didn't do a hundred percent of mitigation.

291
00:39:09.150 --> 00:39:14.370
Russ Snyder: But we were very successful through the supply chain during the pandemic.

292
00:39:15.026 --> 00:39:18.280
Russ Snyder: What's the biggest benefit of modeling and mitigating

293
00:39:18.460 --> 00:39:21.860
Russ Snyder: to me? It's not really for the pandemics.

294
00:39:22.340 --> 00:39:30.580
Russ Snyder: It's for normal cycles that you see, that are less severe than something like a major disruption.

295
00:39:31.130 --> 00:39:37.440
Russ Snyder: As I said, every 3 years we had we had some kind of issue with a supplier or an industry-wide event.

296
00:39:38.650 --> 00:39:51.159
Russ Snyder: and those were less severe cycles. It's dealing with one supplier, or it's dealing with an industry that is constrained on capacitors. Those are the type of things that we faced on a more frequent basis

297
00:39:51.780 --> 00:39:53.970
Russ Snyder: that are much less catastrophic.

298
00:39:54.350 --> 00:40:05.639
Russ Snyder: But the inventory and capacity buffers that we put in place manage through those situations with a lot of out, a lot of extra work and a lot of hand holding with suppliers.

299
00:40:06.580 --> 00:40:13.670
Russ Snyder: And lastly, I'll leave you with the quote from Benjamin Franklin - "An ounce of prevention is worth a pound of cure."

300
00:40:14.300 --> 00:40:15.709
Russ Snyder: And I hope

301
00:40:16.350 --> 00:40:22.690
Russ Snyder: you've had a lot of good takeaways from today, and that your supply chains will become a lot more resilient.

302
00:40:23.020 --> 00:40:25.650
Russ Snyder: and on that I'm going to turn it back over to Brian.

303
00:40:28.280 --> 00:40:36.610
Brian Scarpace: Russ. Thank you so much. That was fantastic. We have a couple of questions we were going to share with you. If that's okay. Russ.

304
00:40:36.830 --> 00:40:37.490
Russ Snyder: Sure.

305
00:40:38.610 --> 00:40:40.930
Brian Scarpace: Alright! Get those up for you.

306
00:40:43.820 --> 00:40:44.850
Brian Scarpace: Sorry about that.

307
00:40:48.390 --> 00:40:49.319
Brian Scarpace: There we go.

308
00:40:51.700 --> 00:41:04.029
Brian Scarpace: So, Russell. One of the questions we had was, "Why is Just In Time still a prominent model for inventory and the lean community, given that even Toyota has had to add buffer inventories?"

309
00:41:07.350 --> 00:41:12.483
Russ Snyder: Well, I I can't say for sure, but I think the biggest thing is

310
00:41:12.970 --> 00:41:17.240
Russ Snyder: Change comes slowly, and when we've taught

311
00:41:17.430 --> 00:41:24.160
Russ Snyder: for so long. That inventory is a waste, and that your best way to

312
00:41:25.090 --> 00:41:29.250
Russ Snyder: get out of inventory being a waste is to do just in time.

313
00:41:29.803 --> 00:41:36.879
Russ Snyder: I think it's hard to undo years of training and years of learning and years of of doing.

314
00:41:37.070 --> 00:41:52.750
Russ Snyder: But I think that you know the opportunity here is that the pandemic has shown us that JIT may not be the best thing. The automotive industry took longer than every other industry to recover, and they primarily use JIT for everything.

315
00:41:53.030 --> 00:42:03.099
Russ Snyder: and if Toyota is willing to bend the lien rules a little bit, I think that the rest of us should be willing to look at some other inventory options and capacity options, as well.

316
00:42:05.980 --> 00:42:13.970
Brian Scarpace: Excellent. Another question we had was, "How easy is it to get accurate supplier capacity utilization forecasts for us?

317
00:42:16.520 --> 00:42:24.549
Russ Snyder: I think this is a blind spot in purchasing organizations contracts with suppliers. I think that we only went out to get

318
00:42:24.710 --> 00:42:31.080
Russ Snyder: detailed capacity information, maybe once a year when we were planning a new product launch.

319
00:42:31.330 --> 00:42:33.229
Russ Snyder: And to me.

320
00:42:33.920 --> 00:42:48.109
Russ Snyder: when ecosystem events occur when suppliers get another customer who has large capacity requirements. It doesn't give us that information that we need to make those decisions and run the model.

321
00:42:48.550 --> 00:43:02.640
Russ Snyder: And it is difficult, and it hasn't been on anyone's radar, and I think that contracts and expectations of suppliers need to be to provide capacity information on a frequent basis, monthly or quarterly.

322
00:43:03.300 --> 00:43:05.980
Russ Snyder: And I also think

323
00:43:07.110 --> 00:43:17.979
Russ Snyder: that, you know suppliers may not want to give you that information, because it is also a negotiating point with customers when they know that you have lots of capacity available.

324
00:43:18.809 --> 00:43:25.280
Russ Snyder: And this is part of the problem with supply chain of value chain is is transparency of information

325
00:43:25.560 --> 00:43:34.019
Russ Snyder: when it becomes about dollars and cents and negotiating. And who has the power? Then some of these things

326
00:43:35.290 --> 00:43:44.480
Russ Snyder: don't get transmitted or exposed to to either party. And that's what really the problem is, is dollars

327
00:43:44.900 --> 00:43:52.859
Russ Snyder: when it might impact your ability to negotiate a better price with your customer. They don't want to tell you that they don't. They have a lot of capacity available.

328
00:43:55.960 --> 00:43:59.200
Brian Scarpace: Excellent Russ, I don't see any more

329
00:43:59.490 --> 00:44:10.336
Brian Scarpace: questions, but we just thank you so much, Russ. That was fantastic. And if anybody has any questions after the event, please feel free to share them, and we'll we'll send those along. And then,

330
00:44:10.850 --> 00:44:36.220
Brian Scarpace: just a couple of things I wanted to run through here before we conclude. Just want to let you know that we just released our 2024 Insights on Excellence Executive Summary and Annual Report, so you can check that out. It includes a few items for you to review and share with your team as well. It includes a overview of our Association Highlights for ASQE as well as our Association Impact Report.

331
00:44:36.220 --> 00:44:43.690
Brian Scarpace: And then it also includes the Insights on Excellence research that we've had. This is the good stuff this talks about some of the emerging trends that we see in our research.

332
00:44:43.690 --> 00:45:02.569
Brian Scarpace: And then we also talk about in the Insights on Excellence research our Annual Report, the looking forward to '25. So, these are ways that ASQE is supporting our organizations and advancing our mission. You can download the report complimentary download at insightsonexcellence.org, or you can use the QR code that you see on the screen.

333
00:45:04.840 --> 00:45:30.990
Brian Scarpace: If you enjoyed today's event, we hope you can join us on February 20th. We're going to host Member Benefit Session focused on Certification, and whether you have a certification from ASQ, or you're thinking about one, this is a great event to to join us. Invitations will be going out next week, and you know, please invite a friend. If you have somebody at your organization who would like to learn more about the Certifications that ASQ makes available or recertification, please join us for that.

334
00:45:31.150 --> 00:45:48.179
Brian Scarpace: Also coming up, ASQ is hosting a Lean and Six Sigma Conference in on February on in Phoenix on February 23rd through 25th and the theme will be "Keeping the Pulse on Quality." So, hope you can join us in Phoenix for that; it's a great place to be in February.

335
00:45:48.510 --> 00:46:15.289
Brian Scarpace: So, if you if you wouldn't mind to help us out, Russ. Thanks again so much. This was fantastic. I'm just gonna ask our audience if we'll put a survey in the chat. If you can let us know, it's a 3-question survey, if you can take that and let us know what you thought about today's event, your experience. This really helps us out and helps us kind of shape the content that we have going forward. So, really appreciate it. Thank you again for your membership. Russ, thank you again

336
00:46:15.470 --> 00:46:17.340
Brian Scarpace: for making today possible.

337
00:46:18.370 --> 00:46:19.640
Russ Snyder: Thanks for having me.

338
00:46:20.110 --> 00:46:20.770
Brian Scarpace: Alright.

339
00:46:21.120 --> 00:46:22.399
Brian Scarpace: We'll see you next time.