



From Just-in-Time to Just-in-Case: Building Supply Chain Resilience in an Era of Sustained Disruption

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Abstract

For decades the dominant philosophy in supply chain management was to pursue efficiency at all costs, with lean, just-in-time thinking encouraging organisations to strip out inventory, shorten lead times and buy from the cheapest suppliers wherever they were. The shocks of the early 2020s, the pandemic followed by geopolitical, climatic and logistical disruption, exposed the fragility this single-minded pursuit of efficiency had built up. This paper examines the move from just-in-time to just-in-case, the deliberate use of buffers, redundancy and flexibility to manage disruption, drawing on a survey of 234 supply chain and operations professionals and a literature review. It asks how organisations have changed their strategies, which resilience measures they have adopted, and how they balance efficiency against resilience. The findings show a clear, widespread move to resilience-oriented practice: around eighty per cent report diversifying their supplier base (80.3%) and investing in supply chain visibility (81.6%), while the strongest single endorsement (85.0%) is that the goal is a sensible balance between efficiency and resilience rather than the abandonment of efficiency. Chi-square goodness-of-fit tests confirm these distributions depart significantly from chance ($p < .001$). Respondents remain keenly aware that resilience carries costs. The paper argues that just-in-time and just-in-case are two ends of a spectrum on which firms must locate themselves by risk exposure, and that the most durable response to sustained disruption is a strategic capability for resilience rather than a one-off stock of buffers. It closes with practical guidance for supply chain leaders, executives and educators.

Keywords: *supply chain resilience, just-in-time, just-in-case, lean management, supplier diversification, nearshoring, supply chain visibility*

1. INTRODUCTION

For the most part, the story of modern supply chain management is the story of the conquest of inventory. For much of the twentieth century, manufacturers routinely carried large inventories of raw materials, parts and finished goods as a matter of course. Inventory was viewed as a reasonable safeguard against uncertainties of supply and demand. The emergence of lean thinking, and the just-in-time approach that emerged in Japanese manufacturing and was later studied and copied worldwide, redefined that inventory as waste. The central insight of lean was that inventory hides problems. Inventory ties up capital and hides inefficiency. An



organisation that learned to run with minimal stock would be forced to solve the underlying problems that the stock had previously hidden. For decades this insight yielded stunning improvements in cost, quality and speed, and just-in-time became something akin to received wisdom across world manufacturing and retail.

The same logic, carried to its global conclusion, resulted in supply chains of great length and complexity. Organisations purchased components from the cheapest sources, often concentrating their procurement on a small number of highly efficient suppliers in a small number of locations, and they depended on fast, reliable, cheap transportation to knit these dispersed elements together. The result was a global system optimised for efficiency in normal times, where goods flowed smoothly from areas of low-cost production to markets all over the world with very little slack anywhere in the system. In normal conditions this system worked beautifully, it meant a lot of cheap goods and rewarded the organisations who had pushed efficiency furthest.

The problem, as the early 2020s painfully showed, was that things didn't stay normal. The pandemic hit production and transportation simultaneously, everywhere, showing how little slack there was in the tight global system. A factory closure in one country could stop production on the other side of the world. A shortage of shipping containers or a blocked canal could send ripples through industries that had no obvious connection to shipping. A boom in demand for one category of goods could reveal the incapacity of finely tuned supply chains to flex. The disruptions did not end with the acute phase of the pandemic. This was followed by geopolitical tensions that questioned the wisdom of concentrated global sourcing, climate-related events that disrupted production and logistics, and a general recognition that the world had entered a period in which disruption was the norm rather than the exception.

The counter-philosophy to this has become fashionable, often shortened to just-in-case. Where just-in-time sought to eliminate buffers, just-in-case seeks to rebuild them in a purposeful way. The form of this rebuilding is in safety stock, diversified suppliers, regionalised production and slack capacity. The aim here is to allow the supply chain to withstand the shocks that the lean system had left it exposed to. The change has been described in dramatic terms as a wholesale repudiation of lean thinking, but the reality on the ground is more nuanced. Very few organisations want to give up the real benefits that efficiency brought. The costs of holding large buffers are real. The majority of organizations do not appear to be looking for a return to the inventory-laden days of yesteryear, but rather for a more rational equilibrium where efficiency is tempered by a deliberate investment in resilience proportionate to the risks they actually face.

The paper adopts a grounded perspective on that shift. It views the shift from just-in-time to just-in-case not as a fad or a panic, but as a considered response to a changed risk



environment, and it tries to understand how organisations are actually negotiating the tension between efficiency and resilience. The aim is to demonstrate the evolution of supply chain strategies in the wake of the latest wave of disruptions, the resilience measures organisations have put in place and how they are weighing the costs of resilience against the benefits. The paper is organised in the conventional way, starting with a review of the relevant literature, setting out objectives and hypotheses, describing the research methodology, and presenting data analysis supported by chi-square tests. It concludes with findings, implications for practice and directions for future research.

2. REVIEW OF LITERATURE

The intellectual origins of lean supply chain management are generally credited to the Toyota Production System and Western scholars' study of that system. In an influential account of the system, Womack, Jones and Roos (1990) brought the principles of lean production to a wide audience, establishing just-in-time and the elimination of waste as central tenets of operational excellence. Ohno himself wrote extensively on the Toyota system, and expressed the philosophy from the inside. Inventory was the most fundamental form of waste, because it hides the problems that an organisation should be solving. This body of work defined the practice of manufacturing for a generation, and is still foundational, even as the recent disruptions have led to a reconsideration of how far its logic should be taken.

Supply chain resilience was a concept before recent disruptions, but it's become hugely more important since. One of the seminal treatments was by Christopher and Peck (2004) who defined resilience as the ability of a supply chain to return to its original state, or to move to a new and more desirable state, after being disturbed. They identified a number of principles for building resilience including, among others, the engineering of supply chains for flexibility, the creation of redundancy where it is justified and the development of a culture that takes risk seriously. Their work was prophetic in arguing that the constant push for efficiency could undermine resilience, and that organizations had to balance the two instead of seeing efficiency as the only goal.

In his popular treatment of the resilient enterprise, Sheffi (2005) examined how organisations could prepare and recover from major disruptions. He presented many case studies to support the argument that resilience is generated by a combination of redundancy and flexibility, with the latter generally more valuable as it provides benefits under normal conditions as well as during disruptions. His work provided the influential idea that investments in resilience need not be pure insurance costs. Many of them, such as flexible production capabilities and strong supplier relationships, improve everyday performance while also protecting against shocks. This insight has become central to the contemporary discussion, because it provides a way out of the apparent trade-off between efficiency and resilience.



There has been a lot of research on the trade-off between efficiency and resilience. The literature on the so-called efficiency-resilience trade-off recognises that buffers, redundancy and diversification come with costs, and that an organisation cannot optimise both efficiency and resilience at the same time. Tang (2006) set out an early and influential catalogue of robust strategies for mitigating disruption, observing that the more attractive of these strategies are those that pay their way under normal operating conditions and not only during a crisis. A more refined line of work, however, leaning on Sheffi's insight, indicates that the trade-off is not always as harsh as it appears. Investing in visibility, flexible capacity and strong supplier relationships can improve resilience, as well as delivering operational benefits, shifting the frontier rather than simply moving along it. Pettit, Croxton and Fiksel (2013) gave this idea practical form, developing an assessment tool that matches an organisation's vulnerabilities against its capabilities and warning that too little resilience leaves a firm exposed while too much erodes profitability. This distinction between resilience measures that are pure costs, and those that also deliver everyday value, has become an important theme in the practical literature and is reflected in the choices organisations make about which resilience measures to adopt.

The recent turmoil has generated a large body of new empirical literature. The concept of ripple effect was introduced by Ivanov and Dolgui (2020) to characterize propagation of a disruption in a supply chain network from one point to another. The related concept of viability was developed as a property ensuring that a supply chain can survive over the long term in a changing environment. Much of their work was done in the midst of and immediately after the acute phase of the pandemic and helped to codify the lessons that practitioners were learning in real time. They argue the pandemic was not merely a big disruption, but a different sort of disruption, one that was simultaneous and global, that revealed the limits of resilience strategies designed for localised and temporary shocks.

There is an increasing literature on the concepts of nearshoring, reshoring and regionalisation in relation to the specific question of sourcing strategy. The logic of efficiency advocated for concentration of global production in a few low-cost locations. However, when those locations are disrupted, or when geopolitical tension makes reliance on them a risk, the concentration of production is perceived as a source of fragility. There is increasing interest in the literature to move production closer to the end markets, to diversify the geographic base of supply and to build regional rather than purely global supply networks. This work generally warns, however, that these strategies come with significant costs and complexities, and that wholesale reshoring is neither feasible nor desirable for most products; a more common and realistic response is selective diversification and regionalisation rather than a complete unwinding of global supply chains.

Supply chain visibility has emerged as a central theme. The recent literature makes it clear that many organisations were caught out by disruptions not because the disruptions were



unforeseeable, but because they did not have visibility into their own supply chains, especially beyond the immediate supplier level. Organisations often did not know who their suppliers' suppliers were and therefore could not assess their exposure to a disruption affecting a distant tier of the network. The literature describes the creation of multi-tier visibility, enabled by digital tools, as one of the most valuable resilience investments available, because it allows an organisation to anticipate and respond to disruptions rather than simply absorb them. Visibility in this sense is a resilience measure, but also provides everyday operational benefits thus placing it in the more attractive category identified by Sheffi.

A further and fast-growing strand of recent work (2023–2025) reframes visibility as one part of a wider digital transformation of the supply chain, and it is worth dwelling on because it speaks directly to how the resilience measures discussed above are actually delivered in practice. The argument running through this literature is that technologies such as the internet of things, big data analytics, artificial intelligence and blockchain have moved from the periphery to the centre of resilience-building, because they sharpen an organisation's ability to anticipate disruption rather than merely absorb it. Gupta, Modgil, Choi, Kumar and Antony (2023) provide empirical evidence that artificial intelligence and blockchain together strengthen the financial resilience of supply chains, the former by improving prediction and decision-making and the latter by adding transparency and trust across organisational boundaries. In a systematic review of the field, Şerbetçioğlu and Oflaç (2024) identify the adoption of these digital technologies, alongside agility and collaboration, as one of the dominant emerging themes in the post-pandemic resilience literature. What this body of work adds to the present study is a recognition that predictive analytics and artificial intelligence can shift resilience from a reactive posture, in which an organisation holds buffers against shocks it cannot see, towards an anticipatory one, in which it senses and responds to disruption as it develops. Importantly, the same literature is candid about the obstacles, noting that the cost of these systems, concerns about data privacy and the difficulty of integration mean the benefits are far from automatic. Al-Banna, Yaqot and Menezes (2023) make this tension explicit, arguing that organisations need a structured roadmap towards digital supply chain resilience that strikes a balance between resilience and vulnerability without eroding profit, an argument that maps closely onto the broader efficiency-resilience balance that this paper takes as its central concern.

The broader frame offered by the literature on organisational resilience is useful. Resilience is defined as a built capability, encompassing anticipation, coping, and adaptation, by Lengnick-Hall, Beck, and Lengnick-Hall (2011) in their research on resilience capacity, and further elaborated by Duchek (2020). When applied to supply chains, this framing shifts the focus away from the accumulation of buffers as a one-off response and towards the development of an ongoing capability to anticipate, withstand and adapt to disruption. This perspective also helps to explain why the smartest organisations have their objective not as a move from just-



in-time to just-in-case but as the development of a more flexible and adaptive supply chain that can sensibly locate itself somewhere on the spectrum depending on circumstances. In this sense, resilience is a capability, not a stock.

Finally, there is a growing body of work that has investigated the relationship between supply chain resilience and sustainability, two agendas that are sometimes in conflict and sometimes mutually reinforcing. Holding more inventory and building redundant capacity can increase resource use and waste, working against sustainability objectives. Diversification and regionalization can reduce the carbon intensity of long-distance transportation and improve supply chain transparency. The literature suggests that resilience and sustainability should be seen in combination rather than isolation, as actions taken for one can support or work against the other. Those organisations best set up for the future will be those that find ways of pursuing both objectives at the same time. This integrated perspective links the supply chain literature with the wider management debate on how organisations should navigate in an environment of competing pressures.

Pulling the threads together, the literature provides fairly clear explanations of the lean underpinnings of modern supply chains, the concept and principles of resilience, the nature of the efficiency-resilience trade-off and ways of mitigating it, the lessons from recent disruptions, the sourcing strategies organisations are rethinking, the central importance of visibility, and the value of treating resilience as a capability rather than a stockpile. What is less well mapped is how practitioners themselves describe the changes they have made, how they weigh the costs and benefits of resilience and how they understand the relationship between efficiency and resilience in their own organisations. This study contributes modestly to that gap by examining the perceptions of a sample of supply chain and operations professionals as they describe the evolution of their strategies in response to persistent disruption.

3. OBJECTIVES OF THE STUDY

- To examine how organisations have shifted their supply chain strategies from just-in-time toward just-in-case in response to sustained disruption.
- To evaluate the relationship between resilience-oriented measures and organisations' confidence in their ability to withstand future disruptions, and how they balance these measures against efficiency.

4. HYPOTHESES

- H1: Recent supply chain disruptions have significantly influenced the shift from just-in-time toward just-in-case resilience measures.



- H2: The adoption of resilience-oriented measures significantly influences organisations' confidence in withstanding future disruptions and their approach to balancing resilience with efficiency.

5. RESEARCH METHODOLOGY

The study is quantitative in nature and is informed by a focused literature review. Primary data were collected using a structured questionnaire distributed to 234 professionals in supply chain, procurement, logistics and operations functions within organisations that manage physical supply chains. A purposive sampling strategy was used to reach respondents with direct responsibility for, or close working knowledge of, supply chain decisions, and this was supplemented by snowball sampling, in which initial respondents were asked to forward the questionnaire to suitably placed colleagues. Initial contact was made through professional networks and two industry associations. The questionnaire was distributed to roughly 360 individuals, of whom 234 returned usable responses, giving an effective response rate of about 65 per cent. Snowball sampling was appropriate here because the relevant population, namely experienced supply chain and operations professionals, is dispersed and not easily reached through a single sampling frame, although it is acknowledged that the approach trades representativeness for access.

The achieved sample spanned a reasonable spread of sectors and roles. By sector, manufacturing accounted for roughly a third of respondents (around 34 per cent), with the remainder drawn from retail and consumer goods (about 22 per cent), pharmaceuticals and healthcare (about 16 per cent), automotive and electronics (about 15 per cent) and a residual group of logistics service providers and others (about 13 per cent). By role, most respondents (around 65 per cent) were in middle-management or specialist positions such as supply chain manager, procurement lead or operations planner, while the remaining 35 per cent held senior management responsibility for supply chain or operations, giving a view from both strategic and operational levels. The sample was experienced: approximately seven in ten reported more than ten years in the field, which matters for a study that relies on respondents being able to compare practice before and after the recent disruptions. In terms of organisation size, a little over half worked for large organisations with more than a thousand employees, with the balance in small and medium-sized firms. Most respondents were based in India, with a minority working for the local operations of multinational organisations, so the geographic reach of the sample should be read with that concentration in mind.

The questionnaire used five-point Likert scales from strongly disagree to strongly agree. A pair of scales was made. The first was the transition from just-in-time to just-in-case, including the factors of increased safety stock, supplier diversification, nearshoring and regionalisation, investment in visibility, and the re-evaluation of the pursuit of pure efficiency. The second measured the association between measures of resilience, confidence



in withstanding future disruption and the balancing of resilience versus efficiency. Items included the cost of resilience, the goal of balance rather than wholesale change and confidence in the organisation’s preparedness. Items were based on established instruments in the supply chain management and organisational resilience literature and adapted to the current context. The instrument was reviewed by three academic reviewers and two practising supply chain managers prior to finalisation and minor wording adjustments were undertaken to improve clarity. This expert review served as a check on content and face validity, confirming that the items covered the intended aspects of the just-in-case shift and the resilience-efficiency balance and that the wording was clear to practitioners. The internal consistency of the two scales was assessed using Cronbach’s alpha. Both scales were satisfactory, with the just-in-case measures scale returning an alpha of .84 and the resilience-balance-and-confidence scale an alpha of .81, comfortably above the conventional threshold of .70 and indicating that the items within each scale hang together reasonably well.

Descriptive statistics and non-parametric tests were used to analyze the data. Chi-square goodness-of-fit tests were used to determine if the distributions of responses were significantly different from the uniform pattern expected if the items did not discriminate between agreement and disagreement. All tests were run at the 95 per cent confidence level. The study followed standard ethical procedures for survey research. Participation was entirely voluntary, and the questionnaire opened with a short statement explaining the purpose of the study, the intended use of the data and the respondent’s right to withdraw at any point before submission; respondents indicated their informed consent before proceeding. Respondents were guaranteed anonymity and confidentiality, and no information that could identify individuals or their employers was collected. Responses were stored securely, used only in aggregate for research purposes, and reported in a way that prevents any individual or organisation from being identified. The sample is small and the design is cross-sectional, limiting causal inference and generalization outside the studied population. The findings are therefore to be understood as descriptive of the sample and suggestive for the larger conversation, and not as conclusive evidence concerning all organizations. Despite these limitations the data are sufficient to describe the general patterns that the study tries to capture.

6. DATA ANALYSIS

6.1 Shift from Just-in-Time toward Just-in-Case Resilience Measures

Table 1. The shift from just-in-time toward just-in-case resilience measures.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Since the recent disruptions, my organisation has increased the level of safety stock or inventory buffers it holds.	12 (5.1%)	16 (6.8%)	23 (9.8%)	92 (39.3%)	91 (38.9%)
We have diversified our supplier base to reduce dependence on a small number of suppliers or	10 (4.3%)	15 (6.4%)	21 (9.0%)	95 (40.6%)	93 (39.7%)



Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
regions.					
My organisation has moved, or is actively considering moving, some production or sourcing closer to its end markets.	16 (6.8%)	22 (9.4%)	31 (13.2%)	88 (37.6%)	77 (32.9%)
We have invested in better visibility across our supply chain, including beyond our immediate suppliers.	9 (3.8%)	14 (6.0%)	20 (8.5%)	96 (41.0%)	95 (40.6%)
The recent disruptions have caused my organisation to reconsider its previous focus on pure cost efficiency.	11 (4.7%)	17 (7.3%)	22 (9.4%)	90 (38.5%)	94 (40.2%)

Table 1 presents the distribution of answers to five items measuring the change from just-in-time to just-in-case resilience measures, and the same distribution is shown graphically in Figure 1. The pattern is robust and consistent. The highest level of agreement is with the diversification of the supplier base, with approximately eight out of ten respondents agreeing or strongly agreeing that their organisations have reduced their reliance on a few suppliers or regions. It is one of the most direct reactions to the lesson of the recent disruptions that showed the fragility of concentrated sourcing, and its prominence suggests that organisations have taken that lesson to heart. Investment in visibility is almost as strongly agreed, at around eighty-two per cent. This is because, as is well documented in the literature, many organisations were caught out by disruptions they could not see coming, because they lacked insight into the deeper tiers of their supply chains.

The most conspicuous and immediate reversal of just-in-time orthodoxy is the increase in safety stock supported by about seventy-eight per cent of respondents. The intentional hoarding of inventory buffers is exactly what lean thinking tried to eliminate, and the willingness of a clear majority to do so signals a real change in priorities. Just as revealing is the re-evaluation of the emphasis on pure cost efficiency, concurred by seventy-nine per cent of respondents. This item captures the philosophical heart of the shift: organisations are not simply adding buffers tactically, they are questioning the single minded pursuit of efficiency that characterised the previous era. The support by so many respondents for this rethinking suggests that the change is deeper than a passing precaution.

The biggest neutral category in the table, at around seventy-one per cent, is the item on nearshoring and regionalisation, which gets the most measured response. This is consistent with literature warning that moving production closer to end markets is an expensive and complex process and that wholesale reshoring is neither feasible nor desirable for most organisations. The more cautious response here is down to the reality that whilst many organisations are re-evaluating their geographic footprint, the actual move of production is a slow and difficult process that outstrips the easier steps of holding more stock and diversifying suppliers. The overall pattern across the table points to a real generality of response but also to pragmatism, with organisations more willing to take the easier resilience measures than the more disruptive ones.

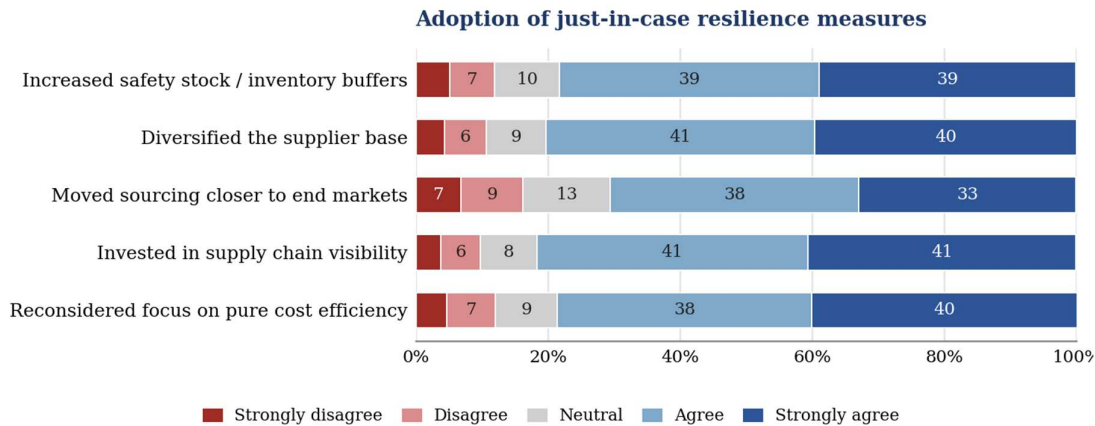


Figure 1. Distribution of responses to the five just-in-case items (percentage of respondents).

6.2 Resilience, Confidence, and the Balance between Resilience and Efficiency

Table 2. Resilience, confidence, and the balance between resilience and efficiency.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The resilience measures we have adopted carry real costs that we have had to weigh against their benefits.	8 (3.4%)	13 (5.6%)	19 (8.1%)	98 (41.9%)	96 (41.0%)
Our goal is to find a sensible balance between efficiency and resilience, not to abandon efficiency altogether.	7 (3.0%)	11 (4.7%)	17 (7.3%)	95 (40.6%)	104 (44.4%)
Some of our resilience investments, such as better visibility, also improve our everyday operational performance.	9 (3.8%)	14 (6.0%)	23 (9.8%)	97 (41.5%)	91 (38.9%)
Senior leadership in my organisation now treats supply chain resilience as a strategic priority.	12 (5.1%)	18 (7.7%)	26 (11.1%)	90 (38.5%)	88 (37.6%)
Overall, I am confident that my organisation is better prepared to withstand future disruptions than it was before.	14 (6.0%)	20 (8.5%)	30 (12.8%)	89 (38.0%)	81 (34.6%)

Table 2 examines how organisations are balancing resilience and efficiency, and their confidence in preparedness, and the distribution is also shown in Figure 2. The answers are revealing. The strongest endorsement, at around eighty five per cent, was for the item in the table that says the goal is a sensible balance between efficiency and resilience rather than the wholesale abandonment of efficiency. This is the one table finding that matters most, as it corrects the simple narrative that just-in-case has won out over just-in-time. The reality described by the respondents is not a victory of one philosophy over the other, but a search for a more sensible position along the spectrum between them. Organisations have not forgotten the real value that efficiency provided; they are looking to temper it with resilience, rather than abandon it.

This image of pragmatic balance is confirmed by the candid admission by some eighty-three per cent of respondents that resilience comes at real costs. Organisations are not blindly chasing resilience. They understand that buffers, redundancy and diversification all come



with a cost and they are weighing these costs against the benefits. The first, and particularly important, is the recognition that some resilience investments also improve everyday performance, which is agreed by about eighty per cent. This shows the way out of the apparent trade-off identified in the literature. Better visibility and other investments have value in both normal times and times of disruption, making them more attractive than measures that are only insurance. The data suggest that practitioners are aware of this difference and prefer the resilience measures that perform well in normal times.

The items on senior leadership attention and general confidence elicit somewhat more measured responses, at around seventy-six and seventy-three per cent respectively. The confidence item has the largest neutral category in the table. The elevation of supply chain resilience to a strategic priority is real but not universal and the measured confidence about preparedness for future disruptions is, as in comparable studies, arguably a sign of realism rather than weakness. Respondents seem to be reasonably skeptical of claiming they are fully prepared, having experienced disruptions beyond their expectations. The literature on organisational resilience warns against the false confidence that comes from over-preparing for the last crisis rather than the next and the measured responses here may reflect a healthy awareness that the next disruption may take an unexpected form.

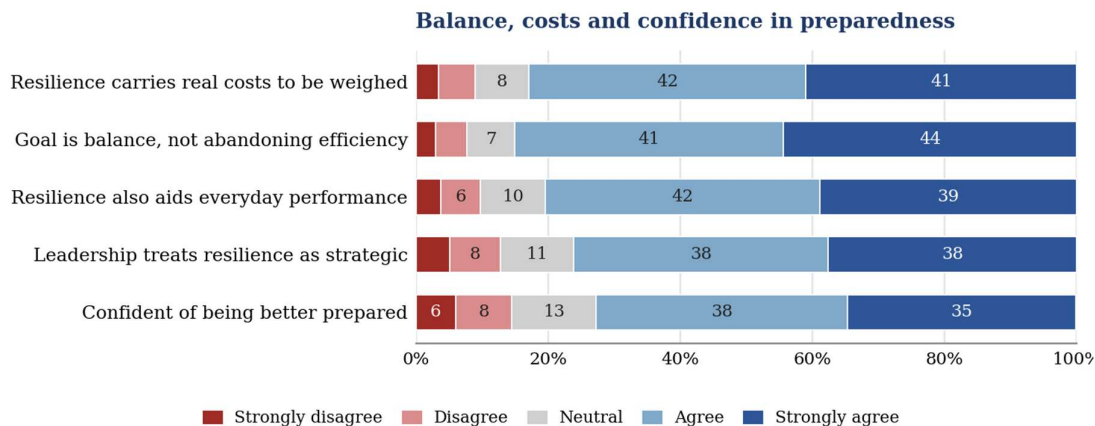


Figure 2. Distribution of responses on balance, costs and confidence (percentage of respondents).

7. HYPOTHESIS TESTING

H1: Recent supply chain disruptions have significantly influenced the shift from just-in-time toward just-in-case resilience measures.

Table 3. Chi-Square Test Statistics for H1.

Statement	Chi-Square (χ^2)	df	Asymp. Sig.
My organisation has increased the level of safety stock or inventory buffers.	148.726	4	.000
We have diversified our supplier base to reduce dependence on a small number of suppliers.	162.394	4	.000



Statement	Chi-Square (χ^2)	df	Asymp. Sig.
My organisation has moved some production or sourcing closer to its end markets.	94.518	4	.000
We have invested in better visibility across our supply chain.	171.052	4	.000
The disruptions have caused my organisation to reconsider its focus on pure cost efficiency.	152.837	4	.000

Table 3 reports chi-square goodness-of-fit statistics for the five items relating to the shift toward just-in-case resilience measures. The values range from approximately ninety-four to one hundred and seventy-one, all comfortably significant at the one per cent level. The highest value falls on the visibility item, and the second-highest on supplier diversification, both of which attracted strong agreement in the descriptive table. The lowest, though still highly significant, falls on the nearshoring item, where responses were most dispersed, reflecting the practical difficulty and cost of relocating production. The tests confirm that response patterns are not consistent with chance and provide statistical support for the first hypothesis. The recent disruptions are clearly and measurably associated with a shift toward resilience-oriented measures in the surveyed population.

The pattern of values is itself informative. The strongest and most settled agreement attaches to the measures that are most accessible and that also deliver everyday value, namely visibility and supplier diversification, while the more dispersed responses attach to the measure that is most costly and disruptive, namely the relocation of production. This distribution suggests that organisations are responding to the disruptions in a rational and graduated way, adopting the resilience measures that offer the best ratio of benefit to cost and disruption before contemplating the more radical and expensive options. The shift toward just-in-case is therefore not indiscriminate; it is a considered reallocation of priorities that favours the measures most likely to pay for themselves.

H2: The adoption of resilience-oriented measures significantly influences organisations' confidence in withstanding future disruptions and their approach to balancing resilience with efficiency.

Table 4. Chi-Square Test Statistics for H2.

Statement	Chi-Square (χ^2)	df	Asymp. Sig.
The resilience measures we have adopted carry real costs that we have had to weigh against their benefits.	183.514	4	.000
Our goal is to find a sensible balance between efficiency and resilience, not to abandon efficiency altogether.	201.762	4	.000
Some of our resilience investments also improve our everyday operational performance.	166.289	4	.000
Senior leadership now treats supply chain resilience as a strategic priority.	118.437	4	.000
I am confident that my organisation is better prepared to withstand future disruptions than it was before.	97.625	4	.000

Table 4 reports the chi-square statistics for the five items associated with the balance between resilience and efficiency and the confidence in preparedness. The values are within the range of approximately ninety-eight and two hundred and two and are all significant at the one per cent level. The highest value, just above two hundred, is on the item about seeking a sensible balance rather than abandoning efficiency, which confirms the visual impression from the



descriptive table that respondents feel decisively about this point. A high value is produced by the frank acknowledgement of resilience costs. The smallest, but still very significant, drop occurs for the overall-confidence item, where responses were most dispersed, indicating the real uncertainty many respondents still have about their readiness for future disruptions. The tests provide strong statistical support for hypothesis two.

It is instructive to note the difference between the two sets of chi-square results. The shift-toward-resilience items confirm the first hypothesis, showing that organisations have changed their practices. The balance items in the second hypothesis confirm that organisations have changed practices thoughtfully, with clear-eyed awareness of costs and a settled determination to balance rather than to abandon efficiency. The two highest chi-square values in the entire study are for the items on seeking balance and on acknowledging the costs of resilience, which together capture the central message: the shift from just-in-time toward just-in-case is real but measured, a recalibration rather than a revolution. The more mixed responses on confidence, and on leadership attention, hint at the ongoing and uneven work of building resilience, and the appropriately humble approach organisations are taking to their levels of preparation for whatever lies ahead.

8. FINDINGS

The analysis yields several clear findings. But the first is that the move from just-in-time to just-in-case is real and widespread. Some 80 per cent of respondents report diversifying their supplier base, 82 per cent report investing in better supply chain visibility, 78 per cent report increasing safety stock, and 79 per cent report reconsidering their previous focus on pure cost efficiency. On this evidence the disruptions of the recent past have led to a real and widespread change in supply chain strategy, not a superficial or temporary adjustment. The lesson that finely tuned, lean and concentrated supply chains hide fragility appears to have been widely learned.

The second is that the shift is graduated and pragmatic rather than indiscriminate. The most easily implemented measures are those that also generate benefits for daily operations, such as visibility and diversification of suppliers, and the most expensive and disruptive measure is to bring production closer to end markets, and so receives the most measured response. This pattern suggests that organisations are behaving rationally, and choosing the resilience measures that strike the best compromise between benefit, cost and disruption. The pivot to just-in-case is a deliberate reordering of priorities, not a frantic throwing out of everything that came before.

The third and perhaps most important finding is that organizations are looking for a balance and not a complete replacement of one philosophy with another. The single strongest endorsement in the study, agreed by around eighty-five per cent of respondents, is that the goal is a sensible balance between efficiency and resilience, not the abandonment of



efficiency. This sets the record straight on the simple story of just-in-case beating just-in-time. Eighty-three per cent agreed that resilience carries real costs and eighty per cent agreed that they favour resilience investments that also improve everyday performance. The picture is of practitioners recalibrating with intention, not losing sight of the importance of efficiency as they invest in resilience.

The fourth finding is a note of cautious realism. Confidence that the organisation is better equipped to withstand future disruptions is the most measured response in the study, with around seventy-three per cent agreement and a substantial neutral category. Respondents who have experienced disruptions beyond their wildest dreams seem appropriately humble to claim they are fully prepared for what comes next. This caution is consistent with the organisational resilience literature, which warns against the false confidence of preparing for the last crisis, not the next. Together, the findings describe organisations that have made real and considered changes, that understand the costs and trade-offs involved and that remain sensibly aware of how much uncertainty lies ahead.

9. DISCUSSION AND IMPLICATIONS

This study paints a picture of thoughtful recalibration rather than dramatic reversal. The disruptions of the recent past have led to a real and broad move towards resilience, but the organisations in this sample are not abandoning the lean principles that delivered decades of gains. Instead, they want a more sensible balance, tempering the quest for efficiency with intentional investments in resilience that are commensurate with the risks they face. This is a more nuanced answer than the simple story that just-in-case overtakes just-in-time would imply. It shows a hard-won recognition that both efficiency and resilience are desirable, and that the optimum position is somewhere in the middle.

There are several implications for supply chain leaders. The first is that the choice is not between just-in-time and just-in-case but where to position the organisation on the spectrum between them, and that this position should be determined by the organisation's specific risk exposure rather than by fashion. A company with key products, highly concentrated supply chains and expensive disruption should have invested more in resilience than a company with less exposure. Secondly, resilience investments should be prioritized based on whether they also provide everyday value. Under normal conditions, as well as during disruptions, measures such as increased visibility and flexible capacity pay off to a greater or lesser degree, which makes them more attractive than pure-insurance measures such as large static buffers. The data suggest that practitioners already understand and act on this distinction.

The special emphasis must be placed on the prominence of visibility. The fact that many organisations were caught off-guard by disruptions they could not foresee due to a lack of understanding of the lower tiers of their supply chains indicates multi-tier visibility as one of



the most valuable resilience investments available. Since visibility also enhances day-to-day operational performance, it is in the most attractive category of resilience measures, protecting against shocks without being a pure cost. Typically, it is better to be able to anticipate and react to disruptions than to just take them on the chin through buffers. Organizations that spend time understanding their supply chains beyond their immediate suppliers, with the right digital tools, will likely be in a better position.

This points to a wider implication about the role of digital technologies in building resilience. The visibility that respondents valued so highly is, in practice, increasingly delivered through digital tools, and the recent literature suggests that the same technologies have a broader part to play. Predictive analytics and artificial intelligence can move an organisation from a reactive posture, in which it holds buffers against shocks it cannot foresee, towards an anticipatory one, in which it detects weak signals of disruption and acts before the disruption fully materialises; blockchain and shared digital platforms can extend transparency and trust into the deeper tiers of the network where visibility has traditionally been weakest. These tools fit neatly into the category of resilience measures that this study finds practitioners prefer, because they protect against shocks while also improving everyday forecasting, planning and coordination, rather than sitting idle as pure insurance. The qualification, well documented in the same literature and worth repeating here, is that these technologies are not a costless fix. They demand investment, clean and integrated data, new skills and attention to data privacy and governance, and organisations that bolt them on without addressing these foundations are likely to be disappointed. The sensible reading for managers is therefore to treat digital capability as an enabler of resilience rather than a substitute for the slower work of redesigning sourcing, relationships and processes, and to sequence investment so that the technologies that also pay their way in normal times are adopted first.

The findings make a stronger case for senior executives to make supply chain resilience a strategic priority rather than an operational afterthought. The recent disruptions showed that supply chain fragility can put the whole organisation at risk, not just the operations function, and the rise of resilience to the executive agenda is a rational response. At the same time, executives should resist the temptation to over-correct, building costly buffers in response to the last crisis rather than the flexible, adaptive capability that the resilience literature recommends. The goal is not to be perfectly ready for another repeat of the last disruption, but to build a supply chain capable of responding to whatever form the next disruption takes - a question of capability, not inventory.

For teachers, the findings argue the case for teaching supply chain management as a discipline of balance, instead of the single-minded pursuit of efficiency that reigned supreme for so long. Future supply chain professionals will need to understand the real value of lean principles, the limitations of lean principles, and build the judgement required to position an organisation sensibly along the efficiency-resilience dimension. Graduates are better prepared



with an education that provides a solid grounding in lean and efficiency but also gives serious consideration to resilience, risk and the trade-offs between these than an education focused on either philosophy alone. The next generation of supply chain leaders will need to be as comfortable with thinking in terms of resilience and risk as their predecessors were with cost and speed.

10. CONCLUSION

This paper has examined the shift from just-in-time to just-in-case in supply chain management, based on a survey of 234 supply chain and operations professionals and a focused literature review. The results point to a real, large-scale switch to resilience-based measures such as supplier diversification, investments in visibility, safety stock increases, and re-evaluation of pure cost efficiency, driven by the recent upheavals. But it is a graduated and pragmatic switch, not a wholesale rejection of one philosophy in favor of the other; organizations are looking for a rational compromise between efficiency and resilience rather than a complete abandonment of one for the other. Chi-square tests suggest that response distributions are unlikely to be due to chance, providing statistical support for both hypotheses. The patterns identified are consistent with the basic findings of the supply chain resilience literature and reflect the particular perceptions of practitioners who experienced the recent disruptions.

The paper has attempted to make the broader argument that just-in-time and just-in-case are best understood not as opposites but as ends of a spectrum along which organisations must position themselves according to their own risk exposure. Decades of lean thinking produced real and tangible gains, and the recent disruptions have not so much invalidated those gains as exposed their limits when efficiency is pursued to the exclusion of all else. The best response to a sustained disruption is not to build a one-off set of buffers, but to build a strategic capability for resilience, including anticipating disruptions, absorbing them when they occur, and adapting afterwards. The organisations that are best placed to thrive in an environment where disruption is the norm not the exception are those that develop this capability and prioritise resilience investments that also deliver everyday value.

There are a number of limitations of the study that should be acknowledged. The sample is small and biased towards certain sectors and roles, limiting generalisation. The cross-sectional nature of the study means findings are correlational and not causal. The instrument is based on self-reported perceptions which have the usual risks of social desirability bias and that respondents portray their organisations as more strategically sophisticated than they are. The study also captures a particular moment, relatively soon after a period of acute disruption, when the salience of resilience is likely to be unusually high. Perceptions may shift as the memory of the disruptions fades and the costs of resilience become more prominent in organisations' thinking. Future work would benefit from longitudinal designs



tracking the evolution of organizations' positions over time, larger and more representative samples, and mixed method approaches that combine survey responses with objective data on inventory, sourcing, and performance.

There are a number of particular paths for future research worth flagging. The question of how organisations should decide where to be on the efficiency-resilience spectrum, given their particular risk exposure, merits further investigation, including the development of practical frameworks to guide the decision. The relationship between supply chain resilience and sustainability can be mutually supportive or contradictory and is worthy of focus given that organisations are actively pursuing both agendas. The role of digital tools in providing the multi-tier visibility that proved so valuable is a rich area for future work. An important question is whether the move toward resilience will be durable, whether this move will persist as memories of recent disruptions fade. Only longitudinal research can answer these questions. Comparative work across sectors with different risk profiles and across regions with different exposures would help clarify which patterns are general and which are shaped by specific circumstances.

If one sentence captures the argument, it might be this: The shift from just-in-time to just-in-case is not the defeat of efficiency by resilience but a search for a wiser balance between the two, undertaken by practitioners who have learned the costs of pursuing either to the exclusion of the other. The data presented here suggest that this search is well underway, and that it is being undertaken with more thoughtfulness than the dramatic headlines about the end of just-in-time would imply. The practical agenda this paper hopes to support is helping organisations to find and hold that balance, through better practice, better tools and better education.

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