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FUTURE-PROOFING LOGISTICS: AN EMPIRICAL INSIGHTS ON INNOVATION-DRIVEN LOGISTICS SERVICE PROVIDERS PERFORMANCE

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Abstract:

Logistics service providers (LSPs) are a significant individual in supply chain management services. The escalating competitive pressures are placing considerable strain on LSP particularly those operating at the local level, as competition arises from both domestic and international. It becomes crucial for LSP to enhance their performance by aiming for growth and long-term sustainability in this industry. Thence, this study explores the direct influence of logistics service capacity on LSP performance, as well as the mediation influence of innovation linking logistics service capability to logistics performance. This study involved the participation of 127 LSP through survey methodology in Malaysia. The study employed Structural Equation Modelling (SEM) using Partial Least Squares (PLS) estimation to examine and test the hypotheses posited in this study. The results provide valuable understandings for LSPs to enhance their logistics services in alignment with highest performance and customer satisfaction. The findings also show that innovation failed to connect the model of logistics performance The findings are necessary to establish a reliable policy in attaining better logistics performance especially during unprecedented situation. This study extends the degree of knowledge

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regarding logistical performance during the COVID-19 epidemic and to the innovation as mediation to attain performance in logistics field.

Keywords:

Logistics Service Providers, Logistics Service Capability, Innovation, Logistics Performance, Third-Party Logistics

Introduction

The service sector holds the foremost position globally and wields substantial influence on the overall global Gross Domestic Product (GDP), accounting for over 60 percent of the world's service trade (Carlos, 2019; The World Bank, 2021; Islam, 2022). Likewise, logistics sector is strengthening and supporting the service sector by efficiently managing and facilitating smooth flow of goods, information, and resources, contributing significantly to its overall effectiveness and success (Lan et al., 2020; Nguyen et al., 2021). Logistics is wide and has an extensive function which would substantially improve our society's standard of living (Chang and Lai, 2017; Winkelhaus and Grosse, 2020). Logistics played its part as early as the beginning of the 1900s and throughout the era, it continues to metamorphose until today (Premkumar et al., 2020).

The World Bank (2017) stated that the average logistics cost would comprise 13 percent of the world's GDP. The cost would go down to 8 percent for well-developed nations and would go up to 25 percent for inefficient nations. Organizations progressively prioritize core competencies to optimize economic of scale, recognizing that strategic alignment holds greater significance than pursuing an exhaustive array of activities. Coherently, the global growth of logistics service providers (LSP) aligns with this trend, as evidenced by the average annual turnover growth rate from 2010 to 2016 was 2.8%, topping 800 billion USD in 2016 (Langley, 2018). In 2015, it was highlighted that approximately half of overall logistics expenses worldwide were attributed to outsourcing, marking a significant increase compared to the previous two years where the figures stood at 36 percent in 2013 and 44 percent in 2014 (Langley, 2016). Akbari (2018) provided support for this trend by noting a 5 percent rise in reliance on LSP in 2016 (68 to 73 percent). This finding further deepened the investigation into the significant growth of global LSP revenues in recent years (Langley and Capgemini, 2016). The global logistics market, valued at USD 261.5 billion in 2022, is projected to reach USD 570.9 billion by 2030. This growth corresponds to an expected Compound Annual Growth Rate (CAGR) of 11.8% over the period from 2023 to 2030 (Hancock, 2023).

The growth of e-commerce has resulting in heightened requirements for logistics services to effectively coordinate and supervise supply chains, ensuring punctual delivery of products. Likewise, the sector has experienced advantages stemming from the progression of technologically sophisticated logistics services and the rising prevalence of interconnected internet of things (IoT) enabled devices. Consequently, LSP must elevate their efforts and explore innovative ways to offer sustainable value propositions that can engage and captivate customers, ultimately enhance performance. The fast-paced transformations in an unpredictable landscape pose a significant challenge for LSP to achieve good performance, particularly in today's economy driven by knowledge and information (Wang et al., 2020; Winkelhaus & Grosse, 2020; Wong & Ngai, 2019). In the era of 21st century, it is no longer about achieving better performance or competition; but to be able to sustain is the critical

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inquiry where only a few can get by (Karaman Kabadurmus, 2020). Thus, there is a need for a LSP to seek out innovative improvement in their firm (Wilson et al., 2015). It was undisputed that to achieve better performance (Islam, 2022; Asian, 2019; Santoro et al., 2018; Zawawi et al., 2017; Saunila, 2016; Wong et al., 2016) and sustainability (Geissdoerfer et al., 2018; Kusi-Sarpong, Gupta and Sarkis, 2019; Kylliainen, 2019), businesses need to evolve and innovate. The inconvenience truth is that preponderant of previous studies on logistics performance were focusing on explaining the general factor and direct relationship (Wang et al., 2020; Wong et al., 2016; Kruasoma et al., 2015; Ho & Chang, 2015) without considering innovation as mediation.

Therefore, to bridge the existing research gaps; this study focuses on the direct influence of logistics service capability on LSP performance. Moreover, this study also investigates the mediation impact of innovation between logistics service capability and logistics performance. Due to the catastrophic COVID-19 pandemic, this study setting to revisiting and expanding previous knowledge on logistics performance on pandemic setting appears both timely and justified. This is because Industrial revolution 4.0, cloud computing and IoT has changed the way organization doing business. To add, this study's finding would reveal whether innovation will enhance the capabilities and performance of LSP during pandemic setting. The findings are necessary to establish a reliable policy in attaining better logistics performance during unprecedented situation, especially for LSPs adapt and change or remain with conventional logistics capabilities services.

Literature Review

Resource-Based View

The RBV theory constitutes of a framework that acknowledges resources and capabilities as fundamental elements and guiding principles contributing to superior firm performance (Wernerfelt, 1984, 1995, Barney, 1986, 1991, 2012). The core focus of RBV stresses the organization's managerial attention in identifying the internal resources such as assets, capabilities and competencies that have the potential to achieve exceptional competitive advantage. Organization that possesses the necessary resources and possess the capabilities to effectively utilize them, it is reasonable to anticipate their success (Tomaz and Barbara, 2009). It has been asserted that an organization can enhance its performance by effectively overseeing and regulating its capacity to acquire resources and capabilities that exhibit value, difficult to replicate, lack substitutes, and rare (Barney, 1991)

Logistics Service Capability

The logistics service capability (LSC) is characterised as the proficiency of a LSP in effectively overseeing and coordinating operations within transportation networks to provide comprehensive logistics services (Ho & Chang, 2015). The objective of LSC is to offer various amenities, such as the transportation of goods or the provision of warehouse facilities to clients. There has been a comprehensive examination of LSC aimed at analysing their influence on firm performance (Cho, Ozment and Sink, 2008; Yang, 2012, 2016; Gligor and Holcomb, 2014; Ho and Chang, 2015). It was also unanimously agreed that a positive correlation exists between LSC and logistics performance. (Ho and Chang, 2015; Mohd Zawawi et al., 2016; Yang, 2016). Thus, the following hypothesis is reiterated:

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H1: LSC has a positive relationship with logistics performance of LSP

Innovation

Innovation can be categorized into technological innovation, organizational innovation, and market innovation (Tidd, Bessant and Pavitt, 2001). Innovation capability highlights an organization's capability to apply new ideas or inventions in developing novel products, services, or processes. Innovation has become a vital attribute for businesses to enhance service performance, including increased production flexibility, enhanced customer service, shorter cycle times, and cost reduction (Hwang, Yang and Hong, 2015; Bakan and Sekkeli, 2017). It would be exceedingly tough for competitors to replicate or mimic a logistics firm that integrates innovation with its LSC (Ho & Chang, 2015; Sauvage, 2003; Slater, 1996). LSPs must consistently seek innovative approaches to optimize their profitability in order to maintain a competitive edge in the contemporary global marketplace. Numerous scholarly have illuminated that the capability to adapt and innovate can enhance outcomes for business enterprises across various dimensions, including but not limited to sales growth, productivity, profitability, market share, competitive advantage, and overall performance (Wong & Ngai, 2019; Shin et al., 2018; Mohd Zawawi et al., 2016; Ho & Chang, 2015; Jayaram et al., 2014). Thus, the following hypotheses are proposed:

H2: LSC has a positive relationship with innovation of LSP

H3: Innovation has positive relationship with logistics performance

Innovation Mediation

The augmentation and sustainability of LSP performance rely significantly on logistics capabilities. Thus, it is imperative for all preceding factors to undergo innovation in order to attain enhanced performance in the marketplace. As per hypothesised in previous sections, it is unanimous that logistics capabilities positively correlate with logistics performance. Nevertheless, advancing a LSP performance can be accomplished through the improvement of its innovation capability (Ho and Chang, 2015; Dangelico, Pujari and Pontrandolfo, 2017) and innovation do help for a long-term sustainability. It was highlighted that firm need to employ resources to enhance the innovation capabilities in order to achieve superior performance. Moreover, A positive and statistically significant correlation exists between resources and logistics innovation; however, this innovation did not impact the performance of smaller firms. Thus, the following hypotheses are proposed:

H4: Innovation mediates the relationship between LSC and logistics performance

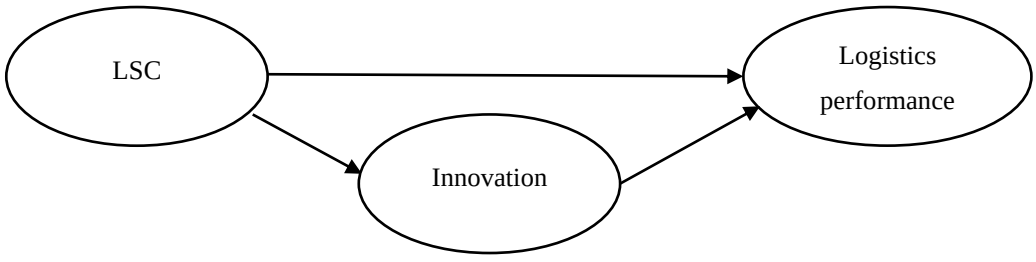

Figure 1: Research Framework

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Research Methodology

Sampling and Data Collection

The primary emphasis of the study is logistics service provider (LSP) in Malaysia. The data were disseminated through an online questionnaire implemented via Google Forms. The survey was administered to the person in charge for each of the chosen LSPs from the Federation of Malaysian Freight Forwarders Malaysia 2021/2022 which consist of three associations. Hence, justifying the application of stratified random sampling in this study. The survey spanned from 1st September 2022 to 31 October 2022, encompassing a duration of two month. From the 600 questionnaire forms sent, only 127 were deemed usable with 23 percent response rate. Hair et al. (2017) stated that with significance level of 0.05 the minimum number respondent for this study is 113. Thus, lack of sample size is not a problem for this study.

Data Analysis

The research is focused on exploration and prediction (Hair *et al.*, 2022). Hence, the assumptions of this study were tested using partial least squares structural equation modelling (PLS-SEM). Before delving into the primary analysis, preliminary assessments, including checks for normality, missing data, and addressing common method variance were undertaken.

Common Method Variance

Common method Variance (CMV) may manifest when the same response method is employed to capture both the independent and dependent variables. CMV happens when a study's data are acquired from a single source, and the same individual replied to the dependent as well as the independent variables (Podsakoff, MacKenzie and Podsakoff, 2012). There were several steps taken to reduce CMV. First, participants were not obligated to reveal their personal information and were guaranteed full confidentiality. Second, Harman's single-factor analysis was conducted on all research measures. The findings demonstrated that no one factor contributed for more than half of the variation, showing the lack of CMV in the data. Lastly, Kock (2015) stated that a thorough evaluation of full collinearity need to be done to detect whether CMV is contaminating the data. Each variable undergone regression analysis involving dummy variables, revealing no evidence of CMV as all Variance Inflation Factors (VIF) remained within an acceptable range (< 3.3).

Measurement Model

According to Hair et al. (2022), measurement model of a structural modal is to determine whether the indicators are in consistent with the constructs measured. The analyses of measurement model can be established by convergent validity (Composite Reliability (CR), Cronbach Alpha, average variance extracted (AVE)) and discriminant validity (Heterotrait-monotrait ratio (HTMT)). To establish convergent validity, it is essential for the loadings and composite reliability to be equal to or greater than 0.7, and the average variance extracted (AVE) must equal or exceed 0.5. To establish discriminant validity, the HTMT values need to be less than 0.85 (Kline, 2011). **Table 1** illustrated the result of the convergent validity of this study. All of the convergent validity's values which are CR, Cronbach alpha and AVE exceed the minimal requirement. Some of the items were not remove due to their AVE and CR already exceeds the minimal requirements therefore is retained for data collection. In **Table 2**, all the HTMT ratio values are below than 0.85 thus confirming the discriminant validity test. Overall, this analysis passes the measurement model analysis.

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Table 1: Convergent Validity

variables and items		Loadings
LSP performance (CR=0.900; Cronbach's α=0.899; AVE=0.522)		
LP1	Our company is excellent in adjusting to changing customer preferences compared to our competitors	0.699
LP2	Our company is better at dealing with changes in competitors' strategies	0.767
LP3	Our company is better at creating new products than our competitors	0.739
LP4	Our delivery services consistently on time	0.779
LP5	Our company can manage a high volume of daily shipments	0.719
LP6	Our company can accommodate a high loading capacity per shipment.	0.747
LP7	Our company offers reasonable shipping cost	0.733
LP8	Our company offers reasonable distribution cost	0.700
LP9	Our overall logistics performance is better than the industry standard.	0.760
LP10	In general, our logistics performance is exceptional	0.839
LP11	We are competent in completing our logistics responsibilities	0.842
Innovation (Cronbach's α=0.902; CR=0.908; AVE=0.600)		
I1	Our company employs data acquisition technologies like RFID and barcodes for product handling	0.813
I2	Our company manages logistics activities through data communication technologies.	0.801
I3	Our company utilizes automated storage and retrieval systems	0.818
I4	Our firm employs GPS and other technologies related to transportation	0.808
I5	Our company consistently improves its operating systems.	0.835
I6	Our company enforces a quality management system for logistics operations	0.779
I7	Management actively promotes innovative ideas within our company.	0.744
I8	Our company possesses clearly defined innovation strategies	0.757
Logistics Service Capability (CR=0.821; Cronbach's α=0.800; AVE=0.512)		
LC1	Our company excels in managing customer service	0.700
LC2	Our company efficiently manages logistics documentation	0.689
LC3	Our company ensures the safe delivery of customer goods without any damage	0.750
LC4	Our company possesses a dependable tracking system.	0.724
LC5	Our firm provides on time delivery services.	0.756
LC6	Our firm can expedite shipments	0.768

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Table 2: Discriminant Validity (HTMT)

	Innovation	LSC	Logistics Performance
Innovation			
LSC	0.669		
Logistics Performance	0.831	0.799	0.809

Structural Model

To determine the significance of path coefficients, a bootstrapping approach with 5,000 samples was used. The outcomes of the hypothesis testing are depicted in **Table 3**. A hypothesis is considered supported when the beta coefficient aligns with the hypothesized direction, the t-value equals or exceeds 1.645 or the p-value is below or equal to 0. 05. It was demonstrated that three of the hypotheses found to be insignificant (H2, H3, H4). While only one hypothesis namely H1 was supported. The coefficient of determination (R^2) for logistics performance is 0.216 and for innovation is 0.234. Predictive relevance (Q^2) pertains to the capability of a model to precisely predict or foresee forthcoming outcomes. Essentially, Q^2 quantifies the extent to which the model harmonizes with the factual observed results, offering discernment into the model's dependability and utility in prognosticating future events or trends. For PLSpredicts, the approach employs both training and holdout samples to produce and assess predictions derived from PLS path model estimations. As per Shmueli et al. (2019)'s criteria, the model is estimated to have mediate predictive power.

Table 3: Hypothesis Testing And Path Coefficients

Hypothesis	Relationship	Beta	T-value	p-value	Decision
H1	LSC → Logistics Performance	0.218	2.991	0.00	Accepted
H2	LSC → Innovation	0.155	1.256	>0.05	Rejected
H3	Innovation → Logistics Performance	0.098	1.101	>0.05	Rejected
H4	LSC→ Innovation→ Logistics Performance	0.066	1.418	>0.05	Rejected
Predictive Relevance (Q^2)					
0.203					
PLSpredict					
Medium predictive power by following Shmueli et al. (2019) evaluation					

Discussion

The findings of the study found that Logistics Service Capability (LSC) is positively relate to logistics performance (β=0.218, *t*-value=2.991, *p*-value= 0.00). This research affirms the hypothesis (H1) that LSC is integral to organizational processes and the value chain. Such capabilities have been recognized as the foundation of a firm's prowess in achieving optimal logistics performance. Most prior studies have also supported the result of the study (Yang, Marlow and Lu, 2009; Lam and Zhang, 2013; Ho and Chang, 2015; Lin and Lai, 2017). For instance, Yang et al. (2009) in their study on shipping services in Taiwan found that LSC exerts a substantial positive influence on overall business performance. In light of unpredictable

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business conditions, and technological advancements, manufacturers and retailers must focus on the logistics function for distinctiveness and competitive advantage. Given the difficulty for businesses to enhance their logistical capabilities internally, companies should respond by investing in logistics expertise through outsourcing.

Secondly, the finding of H2 was discovered that there is no significant relationship between LSC and innovation. (β= 0.155, *t*-value=1.256, *p*-value>0.05). Despite the lack of statistical significance in the findings, it is undeniable that there exists a connection between LSC and innovation in LSP. It is grounded by acknowledging innovation as a crucial attribute enabling LSP to enhance service capabilities such as production flexibility, heightened customer service, reduced cycle times, and cost minimization (Hwang, Yang and Hong, 2015; Bakan and Sekkeli, 2017). Since the beginning of the pandemic in early 2020, Malaysia has undergone multiple waves of COVID-19 infections. The country witnessed a surge in cases, reaching a peak in October. In response, the government implemented stringent measures, encompassing travel restrictions, border closures, and localized lockdowns. Even though the Malaysian government has classified logistics services as essential, the COVID-19 pandemic has led to the implementation of new safety measures such as social distancing within warehouses, disinfection of workspaces, provision of protective gear, and the introduction of policies allowing staff unlimited unpaid time off. The emphasis on sustaining ongoing operations during the pandemic may exacerbate the challenge for firms to engage in innovation, given the additional strain in managing their LSC.

Thirdly, the link between innovation and logistical performance is also insignificant. The statistical finding implies that innovation (β=0.098, t=1.101, P>0.05) failed to have a significant relationship with logistics performance. The hypothesis outcome failed to support the RBV theory where capabilities are the essential element and principles for improved business performance (Barney, 1991). As the population studied was mostly local LSP or SME LSP, it was found that innovation carries a high cost and risk, potentially resulting in undesirable results such as greater market risk, higher expenses, and undesired changes (Banomyong et al., 2008). SMEs often refrain from investing in transformative technologies like ERP and e-HRM due to limited financial resources. Malaysia's logistics ecosystem has always been constrained by a lack of openness, sluggish communication, and manual procedures. Kaufmann & Todtling (2002) stated that SMEs face obstacles such as high-risk innovation projects and expensive technologies, which hinder their innovation endeavours.

The mediation analysis of H4 postulated that innovation fails to mediate the relationship between LSC and logistics performance (β= 0.066, *t*-value=1.418, *p*-value>0.05). As per H4 and H3, thus the mediation criteria do not meet (Hayes, 2009). It can be argued that the regulatory measures implemented during the COVID-19 pandemic in Malaysia did not create a conducive environment for fostering innovation. Still, the relationship between LSC and logistics performance remains statistically significant; thus, it can be deduced that LSC can thrive independently without requiring mediation by innovation. There is no urgency for LSP to innovate in these capabilities as they need to cut as much cost as possible.

Conclusions

The study investigated the effect of innovation in mediating the link between logistical skills and performance. The research provided valuable insights for LSPs to enhance their logistics services in alignment with highest performance and customer satisfaction. The findings showed

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that innovation is vital in connecting the model and enhance logistics performance. The world experiences a sudden bloom of e-commerce and a LSP that is well-equip with bar code technology and electronic data interchange system has higher chance of survivability. Malaysian Investment Development Authority (2023) stated that the pandemic has led to a noteworthy surge in the utilization of digital services among internet users in Malaysia, with around 81% presently participating in such services. Nevertheless, the findings also indicated that LSC do not exert a significant influence on innovation. Consequently, innovation does not have a mediating role in the relationship between LSC and logistical performance. This outcome is unexpected, considering earlier research that highlighted innovation's significance as a pivotal influencing factor and a source of value-generating capability. All in all, the results of our research reveal a substantial level of statistical significance for the majority of the hypotheses examined. Thus, it can be inferred that the proposed model demonstrates superior predictive capability compared to the baseline model.

Theoretical Contribution

The comprehension of logistics and supply chain management performance within the market remains inadequate. Insufficient comprehensive research on the performance of LSP hinders the ability to ascertain their standing amidst market globalization and liberalization. Consequently, this study enhances the current knowledge base by supplying additional insights on the logistics performance of LSPs recognizing the critical nature of the logistics services business as a focal area of study (Akbari, 2018). This research adds to the existing knowledge especially during COVID-19 pandemic situation. Hence, necessitating further scholarly investigation to gain a more profound understanding of this phenomenon. In contrast to prior investigations focusing on the context, it was evident that the economic impact of the pandemic was profound. Consequently, LSP can enhance their readiness for unforeseen circumstances in the future by reinforcing and fortifying their capabilities in logistics service.

Additionally, the majority of prior research on logistics performance primarily concentrated on clarifying the fundamental components and establishing direct associations, assuming that the variables under examination were sufficient to gauge firm performance, without considering innovation as a mediating factor (Wang et al., 2020; Wong et al., 2016; Ho & Chang, 2015). A limited number of studies have investigated the mediation connection between innovation in logistics capabilities and firm performance compared to other sectors (Gustafsson, Snyder and Witell, 2020; Huo, Guo and Tian, 2022; Islam, 2022; Puni *et al.*, 2022). Thus, the research offers valuable on innovation mediation in logistics field.

Interestingly, despite the adverse conditions posed by the calamitous pandemic, LSC managed to achieve logistics performance. In elucidation, the Malaysian government designated logistics services as essential during the COVID-19 pandemic (BERNAMA, 2021). This recognition was of paramount importance to ensure the uninterrupted operation of the supply chain and to meet the essential needs of individuals during the challenging period of the pandemic. Consequently, it can be deduced that the LSC is autonomously linked to the performance of LSPs, playing a critical role in facilitating the continuity of the nation's healthcare and economic sectors through the interconnected supply chain even without mediation by innovation.

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Managerial Implication

The results underline the significance of logistic service capability in improving logistics performance. LSP's management should give serious consideration to these variables as to improve the competency of the logistics industry. In cases where a limited number of employees were permitted to return to work; this study assists managers and practitioners in efficiently leveraging resources and optimizing logistics and supply chain decisions in order to deploying resources strategically. It is also recommended that managers to focus on the variables that provide superior performance to better leverage their advantage during pandemic. LSP' managers need to design a future contingency plan to confront with future unforeseen situation.

Also, it is imperative for LSPs to explore strategies that can enhance their innovation capabilities. The establishment of essential capabilities emerges as pivotal in achieving a heightened level of innovation performance. For instance, government should facilitate collaborative ventures among all logistics players either local, multinational corporation and international LSP to bolster their capabilities through knowledge transfer and exposure to cutting-edge technologies. Also, a policy that incentivize small and medium-sized LSPs to integrate innovation into their logistics and supply chain practices. Such measures might encompass financial incentives, pilot initiatives, and tax incentives to stimulate innovation in logistics. The government can also augment the LSPs to embrace and adapt to innovation by acquiring a more extensive range of relevant logistics technologies. This may involve encouraging and supporting employees to acquire proficiency in new technologies through training, transforming them into knowledgeable workers capable of effectively managing logistics technologies.

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