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Supplier Dependence and Business Performance: The Moderating Role of Supply Chain Diversification

Md Aman Ferdoush Afridy[1*], Amena Akter Rima[2], Md Hasibul Islam Santo[3], Tasmin Rahman[4]

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ABSTRACT

Business organisations may have switched costs and experience disruption if they have to rely on a single supplier to obtain essential input. This study looks at the correlation between supplier dependence and business performance between the two and whether this correlation is moderated by supply chain diversification. Fifteen items were included in a survey framework to measure supplier dependence, supply chain diversification and business performance based on their organisational experience of the previous year. 320 eligible and complete records were analysed using partial least squares structural equation modelling, bootstrap inference, conditional effect analysis and predictive assessment methodology. The indicator loadings were between 0.820 and 0.889, the composite reliability ranged between 0.929 and 0.940 and the average variance extracted ranged between 0.722 and 0.757. The results indicate that supplier dependence is negatively related to business performance (β = -0.402, $p < 0.001$), while diversification of supply chain positively influences the business performance (β = 0.385, $p < 0.001$). The buffering interaction appeared to be verified by the positive interaction coefficient (β = 0.183, $p < 0.001$). Although negative at both low and high diversification, the magnitude of the conditional dependence coefficient decreased from −0.598 at low diversification to −0.206 at high diversification. The complete model explained 35.2% of the variance in business performance. All five performance indicators had positive values of predictive relevance and they out-predicted the linear benchmark. The results suggest that diversification is a positive performance correlate and a diversification of exposure for supplier dependence. Actively managed supplier relationships, critical inputs evaluation, and supplier portfolio management are key focus points in managerial recommendations.

INTRODUCTION

Business organisations rely on outside suppliers to secure the necessary goods, materials, components and services for their core purposes. Ongoing exchanges carry an effect on the organisation's ability to satisfy orders, create production schedules, and accomplish commercial goals. Supplier management thus goes beyond simply buying materials at an acceptable cost. It encompasses choices regarding viable sources, purchasing commitments and preparing to deal with a principal supplier's loss of supply. These decisions relate to structure of supply base with the wider performance of the organisation (Kashem *et al.*, 2024).

Being able to coordinate easily and be familiar with technical requirements can be facilitated when a close relationship exists with a key supplier. In this way, repeated transactions can facilitate communication, minimize uncertainty regarding specifications, and consistent delivery arrangements. However, an organisation can get "hooked" if the relation is one that's hard to replace (Birge *et al.*, 2020). The concept of strategic significance of dependence will be relevant if a supplier failure would disrupt the essential functions of the host entity, if a change of supplier would be time consuming or if a change of supplier would be very costly. In such situations, resources are under the control of other portions of the organisation and the organisation has less flexibility in its sourcing arrangements.

So in evaluating supplier dependence, it's not just about the purchasing concentration but also about the consequences of dependence. A high expenditure share does not necessarily mean the supplier cannot be replaced where other suitable alternatives are easily available. On the other hand, a supplier that supplies a smaller share of total expenditure could be the supplier of a specialised input, which the firm cannot do without. This separation needs to be evaluated as a combination of the three, operational dependence, replacement time and switching cost. This latter understanding is the one taken in the present study and organisational perceptions of the main supplier's importance and substitutability are analysed (Chen *et al.*, 2022).

A related, but different kind of strategic thought is supply chain diversification. An organisation may buy its key inputs from a number of suppliers and have to split the orders between the suppliers and may also have to keep the lines of communication open with other options. The practices provide alternatives that can keep the relationship alive at times of trouble (Khan *et al.*, 2022). A list of potential vendors, however, does not necessarily mean that it is useful diversification. Suppliers need to be able to meet the requirements and the relationship

[1] Economics and Management, Tianjin University, Tianjin, P.R. China
[2] Master's in Economics, Eden Mohila College, Bangladesh
[3] Department of Marketing, East West University, Bangladesh
[4] Department of Economics, Eden Mohila College, Bangladesh
[*] Corresponding author's e-mail: amanferdoushafridy@gmail.com

should be well established to enable actual purchases to take place. The research then measures diversification as the use of multiple supply sources on critical inputs in the year prior to the study (Gu *et al.*, 2022).

There are two analytically distinct dimensions to the diversification–performance association. There will be more sourcing options and flexibility which can lead to improved performance with diversification. Can also help to change dependence by offering options if the primary source is hard to change. The first dimension has to do with a direct connection with performance. The second one relates to moderation; does the negative relationship between dependence and performance lessen as diversification progresses? But first, these dimensions should be understood, to be able to appreciate the linkage between supplier portfolio decisions and organisational outcomes.

The difference also prevents dependence and diversification from being thought of as absolute opposites. An organisation can heavily depend on one supplier for a specific, critical component and have other critical components from multiple suppliers. With a diversified portfolio, a concentrating relationship at an operation bottleneck can coexist. What it does not necessarily mean is that the organisation has a lot of suppliers. Whether the wider sourcing arrangement affects the performance implications of being dependent on an important supplier. A model with dependence and diversification and their interaction explicitly addresses this question.

Business performance is observed, as an overall assessment of the organisation, not as a purchasing result. Measures include business target achievement, management expectations, successful principal business activities, satisfactory commercial results and perception of overall performance strength (Ahsan *et al.*, 2023). This approach ensures the linkage of sourcing arrangements with the overall outcomes of the organisation with a shared assessment period. It also specifies that the result does not refer to the value of a specific audited financial ratio, but to a separately measured operational measure, showing reported performance of the business (Rogers *et al.*, 2024).

The study has three aims. The first is to explore if there is any negative relationship between supplier dependence and business performance. The second is to determine if there are positive linkages between supply chain diversification and business performance. The third is to examine whether diversification has a negative effect on negative dependence–performance relationship. Direct association and conditional relationship are analyzed at the same time in one moderation model that incorporating these objectives. The main research question is about the relationship between supplier dependence and business performance based on the diversification level of the supply chain.

The study contributes a coherent interpretation of supplier vulnerability and sourcing flexibility. What is conceptually interesting about it is that it has the power to differentiate dependence from a main relationship from diversification across the supply portfolio. Empirically, it has an added value to assess the measurement model, the structural relationship, the conditional effects and the predictive performance all in the same analytical framework. The value it adds to management is the demonstration of how an alternative sourcing relationship can be evaluated for its feasibility in reducing exposure. The interpretation that comes from this goes towards a selective approach to diversification, in that the significance of critical inputs and the organisation's ongoing dependence on its primary supplier will be taken into account.

LITERATURE REVIEW

Supplier Dependence as a Resource Relationship

Supplier dependence can be viewed as the organisation's requirement for resources that are in the control of another organisation. The more limited the number of acceptable sources for an essential input, the more the organisation's actions will be related to the choices and capabilities of those sources. More dependence is built when there is a need to access the resource and the other options are not easy to mobilise (Xu *et al.*, 2024). This view calls attention to the intrinsic connection between the need of the business for resources and the discretionary resources that can be used and so forms a basis for the analysis of the relation between external resources arrangement and business performance (Pu *et al.*, 2023).

The criticality of a supplier is related to the importance of the input to the core functions. A relatively inexpensive component can mean the difference between delivering a complete product or not. A service provider is one that is engaged in a specialised activity that cannot be readily relocated (Bednarski *et al.*, 2023). The economic value of the relationship, therefore, can be more prominent than the part that is directly observable in the purchasing process. For a meaningful assessment of dependence to be made it is therefore important to think about the consequences of the loss of the supplier rather than using expenditure or transaction frequency as the sole indicator of dependence (Yang *et al.*, 2023).

Another dimension is switching costs. This can involve the resources needed to qualify a replacement, updates to specifications, new delivery schedules and reestablishing a stable process of purchasing. Time of replacement is also a factor since a technically suitable replacement can be unavailable within the time required to maintain normal operations (Ahsan *et al.*, 2023). This dependence can thereby continue, even if there are other suppliers in principle. The disruption and time and cost and continuity of the study is an indicator of the practicalities of substitution of the organisation under operating conditions (Gebhardt *et al.*, 2022).

Another factor that can affect the discretion in a supplier relationship is dependence. If there is a lack of options within a particular organisation, there will be smaller space

for negotiating delivery change or addressing against the terms of the delivery that are not favourable (Fang, Liu, *et al.*, 2024). These kinds of agreements can reduce the adaptability which purchases decisions can have to shifting business needs. These mechanisms could be used to hypothesize a negative association with performance, but they are not directly measured in the current model. The empirical relationship is assessed on overall dependence level and overall business performance level (Liu & Park, 2021).

Supply Chain Diversification as an Organisational Capability

The supply chain diversification is the extent to which an organization uses multiple sourcing or not to satisfy critical inputs requirements. Its usefulness depends on the availability of other provision arrangements to maintain business operations. An active alternative relationship is not the same as a future supply of an input, where the input has not been supplied before (Hu *et al.*, 2023). The former offers experience in specifications and in purchasing methods and procedures, and its contribution to sourcing flexibility is more tangible. This distinction accounts for the focus on relationships and actual buy on the measurement framework with different suppliers (Rogers *et al.*, 2024).

Diversification can be viewed as a capability of the organisation as it needs to be managed and coordinated to keep several sources of viability. The organisation needs to have a clear view of what it needs to input, evaluate supplier appropriateness and split the purchase activity so as to maintain supplier alternatives (Bukola A. Odulaja *et al.*, 2023). This work includes procurement knowledge and operational planning. Diversification should thus be measured as a characteristic of purchasing behaviour and not just the number of suppliers. The present tense represents the extent and dispersion of critical input sourcing, which indicates that more than one supplier is used for the same inputs regularly (Yin & Ran, 2022).

The quality of alternatives is also highlighted by the capability interpretation. Some vendors may have no real flexibility if they all rely on the same resource which is unavailable, or if they cannot offer the specification required. On the other hand, a few viable alternatives can enjoy significant flexibility (Fang, Yu, *et al.*, 2024). These underlying characteristics are not measured in this study but explain why selective diversification should be undertaken. Strategic intent is to create options for use for critical needs; purchase orders can be managed across the organisation (Bai *et al.*, 2023).

Having several relationships involves some administration, supplier assessment, and communication. The conceptual argument therefore does not suggest that an unlimited increase of the supplier base is a good idea. A workable sourcing arrangement considers alternatives as well as the effort needed to manage them (Jiang *et al.*, 2023). The model looks at the observed diversification–performance relationship in the sample. It is not setting a maximum, or optimum, number of suppliers, and it does not require that all purchasing categories have to use the same allocation method (Lin *et al.*, 2021).

Business Performance in the Supplier Management context

Business performance is the overall success of an organisation in the main activities and in the business goals. Those relationships could help to achieve that success by providing the inputs that the provider needs to operate. Where adjustments to the supply plans are challenging, the organisation might experience a break in supply and/or extra claims for coordination that affect the delivery of the targets (Schmelzle & Mukandwal, 2023). However, higher sourcing flexibility can facilitate the execution of the planned activities. This linkage is the starting point for discussing conditions that affect procurement as well as the results of overall business (Pulles *et al.*, 2023).

The study adopts a perceptual organisational measure as the questionnaire requires knowledgeable people to judge their organisation's experience. The indicators are related to various aspects of overall performance, such as targets, expectations, business activities, commercial results and strength (Pu *et al.*, 2023). The indicators seek to document one construct and by no means five separate dimensions of performance. Their understanding is confined to organisational achievements. This distinction helps to ensure that the questionnaire, the structural model and the inferences from the estimates are consistent (Kashem *et al.*, 2024).

The predictor and outcome assessments are both from a common twelve-month reference period. The respondents make their assessments of dependence, diversification and performance in the same experience of an organisation. The shared reference makes it easier to achieve conceptual clarity as the sourcing relationships mentioned are relevant to the time of assessed business results (Chen *et al.*, 2022). The model so emphasizes the relationships between simultaneous organisational conditions. Performance is reported within the sourcing configuration outlined in the responses, rather than undertaking statistical projections of future commercial results (Khan *et al.*, 2022).

Supplier Dependence and Business Performance

It is assumed that there is negative relationship between suppliers' dependence and business performance if their dependence makes the organisation less able to either continue or change. An organisation that is required to replace a huge amount of time may find it difficult to carry on with normal activity if the main supplier is no longer available (Yang *et al.*, 2023). Even if the relationship survives, the potential for disruptions can impact on scheduling and resource allocation. The management of access to critical inputs may require more dedication or resources to manage, which decreases the flexibility of management to other business priorities (Gebhardt *et al.*,

2022).

Organisational dependence can also limit the organisation's ability to react to opportunities. A change in customer needs, a business expansion or a product change may necessitate new volumes and/or specifications of input. If there is a close relationship with a supplier and the supplier can't meet these needs, it's harder to make the adjustment (Rogers *et al.*, 2024). Conceptually, it is expected that greater dependence should be associated with lower operating position which may manifest itself as lower overall performance evaluations. This expectation is with respect to the direction of the association, after controlling for diversification and the interaction term in the model specified (Jiang *et al.*, 2023).

The first hypothesis is a consequence of the strategic costs of difficult substitution as well as concentrated operational reliance. H1 proposes that supplier dependence has a significant negative relationship with business performance. A coefficient in the moderation model indicates the dependence–performance relationship at the mean level of diversification. This conditional interpretation is required since the relationship is explicitly allowed to vary in the model. It will not take the direct coefficient as a constant value across all the sourcing configurations (Fang, Yu, *et al.*, 2024).

Supply Chain Diversification and Business Performance

Diversification can help the performance of a business by giving the organisation a number of alternatives to acquire some of the factors it needs. An organisation can have multiple active supply relationships and can apportion purchases based on capacity, availability and suitability. This flexibility can help to continue the flow of planned business activities with less difficulty and smooth the sourcing process (Bednarski *et al.*, 2023). So the performance argument doesn't just apply to emergency substitution. A diversified one can provide managers flexibility when normal levels of business operations occur, based on changes in supplier availability and/or organisational need (Khan *et al.*, 2022).

Spending can also be spread out between suppliers to allow for the comparison of commercial and operational alternatives. Knowledge of various sources gives insight on how delivery will be arranged, and if requirements can be met. This information can enhance the decisions on purchasing and decrease the dependence of the organisation on one relationship as a source of information (Yin & Ran, 2022). All of these mechanisms might be an explanation of a positive relationship and the construct measured stays focused on source diversification of the supply. They don't suggest a direct test of supplier competition, purchasing savings or information quality (Bukola A. Odulaja *et al.*, 2023).

Based on the H2, the relationship between SC diversification with business performance is significant and positive. On the interaction model it is interpreted at the level of the supplier dependence. This specification disaggregates the positive relationship of diversification per se from the changing of the dependence coefficient (Pulles *et al.*, 2023). Average levels of dependence can be accommodated by a new sourcing arrangement beneficial to an organisation: the interaction signals if this arrangement is particularly relevant to the implications of dependence (Chen *et al.*, 2023).

The Moderating Role of Diversification

Moderation argument adds in resource dependence and the presence of other supply options. If diversification is low, this could have significant outcomes because the organisation has fewer relationship(s) to fall back on to secure critical inputs from the main supplier (Pu *et al.*, 2023). Again, problems in the main relationship are more closely linked with the organisation's capacity to carry on normal activities. As diversification increases, the alternatives that are currently available may offer more opportunity for relocating purchases or maintaining access to critical inputs (Bukola A. Odulaja *et al.*, 2023).

This argument indicates a buffer phenomena. The dependence – performance relationship should be negative but less so with diversification. A positive interaction coefficient by that pattern is consistent, as it works to offset some of the negative dependence coefficient at higher concentrations of the moderator (Schmelzle & Mukandwal, 2023). The dependence coefficient does not have to be positive for moderation. Nor does it need high diversification to get rid of dependence. The theoretical proposition is related to a modification of the negative relationship at different degrees of diversification concentration (Chen *et al.*, 2023).

But dependence and diversification can coexist, in that the key supplier can still be significant even if there is a more wide-ranging source of supply. Alternatives might be only partial input portfolio purposes or may not have enough capacity immediately available to replace the primary source (Jiang *et al.*, 2023). Partial protection would therefore be indicated by a positive moderation result, as is not independence. This interpretation is particularly appropriate for those organisations which cannot easily cease to rely on a particular supplier but can expand the scope of access to some of the most essential suppliers by establishing more active relationships (Bai *et al.*, 2023).

H3 suggests that diversification of the supply chain is a strong moderating variable that makes the relationship between supplier dependence and business performance to be weaker when diversification is higher. The conceptual framework incorporates two paths to business performance and an interaction between dependence and diversification. These relationships are plotted in Figure 1. Together, the hypotheses differentiate on the one hand the negative relation between reliance and on the other hand the positive relation between sourcing breadth, and the moderating effect of sourcing breadth in the relation between reliance and performance.

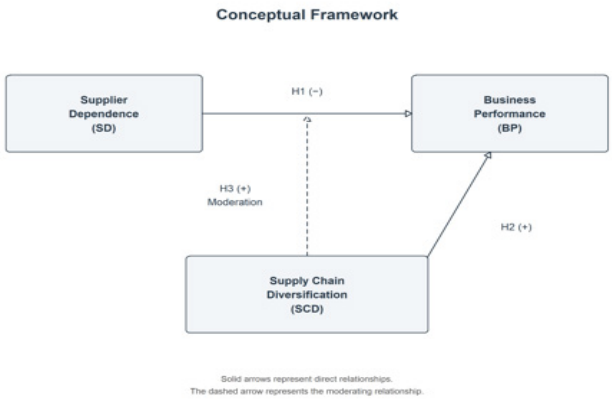


Figure 1: Conceptual framework

MATERIALS AND METHODS

Research Design and Analytical Unit

The study uses a quantitative survey design to explore the relationships between supplier dependence, supply chain diversification and business performance. The unit of analysis was the business organisation. Answers focus on organizational factors and not on the respondent's own individual buying preferences or individual job performance (Sharma *et al.*, 2021). Owners, managers and officers with relevant knowledge are identified as appropriate informants in the questionnaire. This design ensures that information desired corresponds to organisational level where supplier relationships and business results are perceived.

The instrument elicits responses for people to think about what has happened in their organisation in the last year. In order to ensure consistency in the assessments all construct statements are common periods. This analytical model sees suppliers dependency and diversification as explanatory constructs and business performance as endogenous construct. The proposed moderation is represented by their product term. The specification thus tests the three hypotheses in a unified way and allows the dependence coefficient to be different for varying levels of diversification (Cornesse *et al.*, 2020).

Eligibility and Questionnaire Structure

The questionnaire includes statements on respondent and organisational profile as well as on the measurement of constructs, in addition to consent and eligibility questions. Eligibility Criteria includes: Must be 18 years old or older and should have at least 12 months experience in the current organisation and willing for the role. It must also have appropriate awareness of purchasing and supplier relations, the appropriate knowledge of the performance of the overall business and confirmation that the organisation procure goods, materials, components or services from outside the organisation. Six screening responses are needed to be all positive for inclusion (Wang *et al.*, 2024).

The participant information includes a description of the voluntary nature of participation, and the collective academic intent of responses. No personal/ organisational names are asked for in the questionnaire, and respondents can stop whenever they wish, prior to submitting the form. These features refer to the consent built into the instrument. The profile section collects data on age, gender, education, job position, job function, organisational age, sector, size of workforce, ownership and supplier's location and largest supplier's purchasing share. These variables are used to specify the sample, and are not themselves used to create additional structural predictors.

Operationalisation of the Constructs

Five reflective indicators are used to measure each construct which are rated on a five point agreement scale ranging from strongly agree to strongly disagree. Supplier dependence involves the key supplier as well as what happens if that supplier is lost, how long it takes to get another supplier, how much it costs to switch to another supplier and the challenges of continuing business without the supplier (Braun *et al.*, 2021). Primary supplier is determined by whether the goods or services are important to the core operation. This definition is based on dependence in terms of an operation because sometimes the greatest share of spending is not necessarily the most important relationship.

Elements of supply chain diversification include purchasing critical inputs from more than one supplier, spreading purchases among suppliers, keeping alternate relationships alive, having more than one supplier for similar critical inputs and making use of a wide number of sources. Critical inputs are materials, components, goods or services that are vital to the core functions. The indicators are thus related to continuity sourcing behaviour (Holtom *et al.*, 2022). They do not capture other characteristics of supply chain width like customer diversification, number of transport routes etc.

Business performance consists of achievement of overall targets, fulfilment of management expectations, success of principal business activities, satisfactory overall commercial results and good overall performance. Scores above the mean indicate greater acceptance of positive performance items. The higher the dependence score the more dependence and the higher the diversification score the more diverse use of supply sources. This coding maintains the same meaning about the anticipated

signs. The do not know category is kept as a separate response category instead of being recoded as greater concentration and the largest supplier's expenditure share is kept as a separate item (Sharma *et al.*, 2021).

Data Screening and Sample Retention

The analytic records were reviewed in order for eligibility and completeness of measurement. All 320 imported records met the six requirements for eligibility. All fifteen construct responses had to be numeric integers between one and 5 for measurement screening. There were no records dropped due to missing item values, nonnumeric values or incorrect item values. The final analysis thus included 320 complete records with no item imputation. This procedure serves the purpose of assuring a stable base of respondents for the descriptive statistics and the measurement and structural assessments.

In the screening output, repeated complete profiles, as well as repeated measurement patterns were also examined. No repetitions were identified for either type. The screening rules are used to differentiate descriptive pattern screening from single respondent duplicate screening and do not result in an automatic deletion rule based solely on similar answers. The screening decision and retained sample is summarized in Table 1. All results hereafter are based on the same full analysis sample and therefore in principle can be compared directly in terms of the statistical statements made (Becker, 2022).

Table 1: Data screening and sample retention

Screening criterion	Records
Initial imported records	320
Excluded: ineligible or incomplete eligibility	0
Excluded: missing, nonnumeric or invalid item values	0
Total excluded	0
Final analysis sample	320
Repeated complete response profiles: flagged only	0
Repeated measurement-item patterns: flagged only	0

Measurement and Structural Assessment

The reflective measurement model and the suggested moderation structure is assessed using partial least squares structural equation modelling. outer Loading values and outer Loadings2 are used to check the reliability of indicators. Internal consistency is considered by applying Cronbach's alpha, rho A and composite reliability. Average variance extracted is used to evaluate the convergent validity and the heterotrait–monotrait ratio and its bootstrap intervals to evaluate the discriminant validity. The assessments are looked at as a whole, in order to check that the three constructs are measured together in a coherent way which remains distinguishable.

Structural assessment involves predictor collinearity, path coefficients, statistical inference explained variance and effect sizes. For the paths and conditional relationships reported, there are 10,000 valid bootstrap results. Results for the analysis include coefficients, standard errors, test statistics, probability values, and 95% intervals. For hypothesis support, they need to have an estimated direction that is consistent with the proposed relationship and statistical evidence that the corresponding interval does not include zero. Variance inflation are used to determine how different the predictors are in the structural equation (Mirzaei *et al.*, 2022).

Coefficient scaling in the interaction. The results show the coefficient for the score product scale and the standardised interaction beta. The standardised beta summarises H3 and the score scale coefficient is used to interpret conditional dependence slopes. Conditional effects are assessed at diversification values 1 SD below mean, mean and 1 SD above the mean. This distinction will enable us to maintain consistency between the moderation interpretation and the numerical results.

Predictive assessment is the explanation of the variance that is observed. The results of the evaluations reported includes the predictive relevance values, root mean squared errors and mean absolute errors for each business performance indicator. Errors of the PLS specification are contrasted with the errors of a linear model benchmark and 3,200 predictions are reported for each outcome indicator. The positive predictive relevance is the measure of improvement with respect to the training mean benchmark. These are interpreted in the light of the structural results and prediction and explanation are regarded as related, but different types of evidence.

RESULTS AND DISCUSSION

Respondent and Organisational Characteristics

The retained sample comprises respondents from different organisational functions and jobs. The highest age group is 25-34 years (38.75%) followed by 35-44 years (32.81%). 72.50% of respondents are male and 25.31% are female. The percentage of bachelor's degree holders is 44.06% and 31.25% have a master's degree or higher. The middle managers make up 36.88% of the respondents followed by officers/executives at 27.50%. The owner/partner's stake is 17.50%, as is the stake of the senior management. The full profile is presented in table 2 (Pu *et al.*, 2023).

Functional distribution is pertinent to the information the questionnaire will be looking for. There is a 27.50%

for supply chain or logistics, 26.25% for procurement or purchasing and 20.00% for production or operations. Finance or accounts 8.13% and General management 16.88%. The largest category of respondents' tenure is 3-5 years in their current organisation, which accounts for 39.69%. These characteristics are indicative of a sample that has a reasonable number of functions related to supplier relationships and business operations, as outlined in the knowledge questions in the eligibility questions.

Retail and wholesale and manufacturing activities is the biggest sector at 27.81% and manufacturing is the second largest sector at 27.19%. If an organisation has 10 to 49 employees, this represents 31.88% and if 50 to 249 employees is 30.94%. The figure of private limited companies is 45.31% in the sample. 46,88 percent of respondents state that they source locally, 38,13 percent domestic and international, and 15 percent source internationally. For a quarter (26.88%) of organisations, the largest supplier provides 40-59% of expenditure; for a third (30.94%) of organisations, expenditure of 60% or more. These were used to provide context of the numbers that supports the dependence assessment rather than replace the latent construct with expenditure concentration (Birge *et al.*, 2020).

Table 2: Respondent and organisational profile

Characteristic	**Category**	**n**	**%**
Age	18-24 years	19	5.94
Age	25-34 years	124	38.75
Age	35-44 years	105	32.81
Age	45-54 years	48	15.00
Age	55 years or above	24	7.50
Gender	Male	232	72.50
Gender	Female	81	25.31
Gender	Another identity	1	0.31
Gender	Prefer not to disclose	6	1.88
Education	Secondary or below	13	4.06
Education	Higher secondary	27	8.44
Education	Diploma	35	10.94
Education	Bachelor's degree	141	44.06
Education	Master's degree or above	100	31.25
Education	Other	4	1.25
Position	Owner/partner	56	17.50
Position	Senior manager	56	17.50
Position	Middle manager	118	36.88
Position	Officer/executive	88	27.50
Position	Other relevant position	2	0.63
Function	Procurement/purchasing	84	26.25
Function	Supply chain/logistics	88	27.50
Function	Production/operations	64	20.00
Function	Finance/accounts	26	8.13
Function	General management	54	16.88
Function	Other relevant function	4	1.25
Tenure	1-2 years	88	27.50
Tenure	3-5 years	127	39.69
Tenure	6-10 years	92	28.75
Tenure	More than 10 years	13	4.06
Sector	Manufacturing	87	27.19
Sector	Wholesale/retail	89	27.81
Sector	Construction	36	11.25
Sector	Agriculture/agro-processing	52	16.25
Sector	Services	47	14.69
Sector	Other	9	2.81

Organisation age	Less than 3 years	27	8.44
Organisation age	3-5 years	53	16.56
Organisation age	6-10 years	100	31.25
Organisation age	11-20 years	96	30.00
Organisation age	More than 20 years	44	13.75
Employees	1-9 employees	38	11.88
Employees	10-49 employees	102	31.88
Employees	50-249 employees	99	30.94
Employees	250-499 employees	46	14.38
Employees	500 or more employees	35	10.94
Ownership	Sole proprietorship	79	24.69
Ownership	Partnership	57	17.81
Ownership	Private limited company	145	45.31
Ownership	Public limited company	35	10.94
Ownership	Other	4	1.25
Sourcing	Domestic	150	46.88
Sourcing	International	48	15.00
Sourcing	Both domestic and international	122	38.13
Main supplier share	Below 20%	62	19.38
Main supplier share	20-39%	67	20.94
Main supplier share	40-59%	86	26.88
Main supplier share	60-79%	61	19.06
Main supplier share	80% or above	38	11.88
Main supplier share	Do not know	6	1.88

Item Distributions and Indicator Reliability

The mean of the measurement items fall around the middle of the agreement continuum. Supplier dependence: between 2.909 and 3.184; diversification: between 2.819 and 3.153; performance: between 2.894 and 3.234. One to five letters/words are used for all items (full response range). The standard deviation levels vary from 1.125 up to 1.204 which suggests that the organisational conditions reported vary. The descriptive statistics are obtained and presented in table 3. These distributions lend themselves to an interpretation that focuses on the differences between organisations, rather

Table 3: Measurement item descriptive statistics

Item	Mean	SD	Range	Skewness	Excess kurtosis
SD1	2.909	1.204	1–5	0.066	-0.953
SD2	3.069	1.180	1–5	-0.030	-0.911
SD3	2.972	1.181	1–5	-0.037	-0.812
SD4	3.184	1.134	1–5	-0.107	-0.691
SD5	2.962	1.128	1–5	0.047	-0.669
SCD1	2.819	1.168	1–5	0.179	-0.763
SCD2	3.050	1.173	1–5	-0.004	-0.807
SCD3	2.975	1.195	1–5	0.070	-0.890
SCD4	3.153	1.158	1–5	-0.094	-0.760
SCD5	2.944	1.176	1–5	-0.042	-0.813
BP1	2.894	1.183	1–5	0.035	-0.829
BP2	3.100	1.176	1–5	-0.055	-0.871
BP3	3.078	1.135	1–5	-0.115	-0.737
BP4	3.234	1.184	1–5	-0.154	-0.818
BP5	2.897	1.125	1–5	0.031	-0.754

than on generally high or low levels of agreement within the sample.

The highest supplier dependence mean is associated with high switching costs from the primary supplier and the lowest supplier dependence mean is associated with strong dependency to continue the core operations. In diversification, the mean of having frequent purchases of similar critical inputs from multiple suppliers is the highest. Buying from several suppliers has lowest. Performance, satisfactory overall commercial results has the highest mean and achieving overall business targets has the lowest. These comparisons concern the items themselves, and not specific structural effects for specific statements.

20 of the indicators have outer loadings between 0.820 and 0.889. The supplier dependence loadings span from 0.843 to 0.889, diversification loadings range from 0.851 to 0.880 and performance loadings range from 0.820 to 0.878. All indicators are above 0.70 and are kept in the model indicated. The squared loadings for each of these range from .673 to .790, meaning that a sizeable portion of the variance in each indicator is accounted for by the associated construct. As shown in Table 4, each value and a consistent pattern of measurement across the constructs confirms (Yang *et al.*, 2023).

Table 4: Indicator reliability

Construct	Item	Loading	Squared loading
SD	SD1	0.843	0.710
SD	SD2	0.889	0.790
SD	SD3	0.854	0.730
SD	SD4	0.880	0.774
SD	SD5	0.884	0.781
SCD	SCD1	0.855	0.730
SCD	SCD2	0.880	0.774
SCD	SCD3	0.855	0.731
SCD	SCD4	0.851	0.725
SCD	SCD5	0.877	0.769
BP	BP1	0.820	0.673
BP	BP2	0.857	0.735
BP	BP3	0.829	0.687
BP	BP4	0.878	0.771
BP	BP5	0.863	0.745

Internal Consistency and Construct Validity

The internal consistency results indicate that three reflective scales are coherent. The Cronbach's alpha value is 0.920 for Supplier dependence, 0.915 for Diversification and 0.904 for Business performance. Corresponding rho A values are 0.929, 0.917, and 0.906. Composite reliability is 0.940, 0.936, and 0.929, respectively. These findings suggest the five indicators under each construct are presenting consistent information with regard to the underlying organisational condition. Reliability along with the indicator content and validity are considered together, not just as an indicator of sufficient evidence (Bukola A. Odulaja *et al.*, 2023).

The average variance extracted are 0.757 (supplier dependence), 0.746 (diversification) and 0.722 (performance). All values are above 0.50, which is indicative of convergent validity. Constructs thus account for 50% or more of variance in indicators in average. The reliability and convergence statistics are presented in table 5. Both the loadings and variation extracted were significant, offering a comprehensive foundation for interpreting the connections between the structures based on the specified measure.

Table 5: Internal consistency and convergent validity

Construct	Alpha	rho A	CR	AVE
SD	0.920	0.929	0.940	0.757
SCD	0.915	0.917	0.936	0.746
BP	0.904	0.906	0.929	0.722

Note: CR = composite reliability; AVE = average variance extracted.

Results of discriminant validity show that the constructs are still empirically distinguishable. HTMT = 0.038 between supplier dependence and diversification, 0.432 between dependence and performance and 0.449 between

diversification and performance. The corresponding all point estimates and all reported upper bounds of the bootstrap are less than 0.85. The complete intervals are shown in Table 6. The low dependence–diversification ratio is in line with viewing them as distinct characteristics of the organisation. A large sourcing portfolio doesn't mean you don't have a key supplier.

Table 6: Discriminant validity

Construct pair	HTMT	95% lower	95% upper
SD and SCD	0.038	0.039	0.142
SD and BP	0.432	0.327	0.530
SCD and BP	0.449	0.347	0.544

Structural Collinearity and Hypothesis Tests

The variance inflation factors are 1.006 for supplier dependence, 1.007 for diversification and 1.011 for their interaction. All are below 3 and near 1, suggesting a limited amount of linear overlap between the predictors in the structural equation. These results are shown in table 7. The collinearity assessment helps to interpret the direct paths and interaction without undue inflation due to predictor redundancy. It does so by taking care of overlap from the structural, rather than measurement, level, thus complementing the discriminant validity findings (Chen *et al.*, 2023).

Table 7: Structural collinearity

Predictor of business performance	VIF
Supplier Dependence	1.006
Supply Chain Diversification	1.007
SD x SCD	1.011

There is a negative path from supplier dependence to business performance ($\beta = -0.402$, Bootstrap S.E. = 0.042, $t = 9.523$). Its 95% interval extends from −0.483 to −0.321, and $p < 0.001$. H1 is supported. So the more the firms depend on the diversification the worse their reported performance is at the average diversification level. The result is in line with the conceptual expectation that operational dependency and ease of substitution is negatively associated with a business' position. Its interpretation is about the estimated organisational association and not about specifying the coefficient to a particular unmeasured mechanism for disruptions.

The diversification path has a positive effect on performance with $\beta = 0.385$, SE = 0.043 and $t = 9.002$. The 95% interval ranges from 0.300 to 0.469, and $p < 0.001$. H2 is supported. Wide utilization of supply sources is linked to a high performance level at average supplier dependence. The two direct coefficients are of comparable absolute size but the analysis does not propose any statistical test to check the difference. Their signs show dependence and diversification to be associated with performance on opposite sides of the range in the specified model (Pulles *et al.*, 2023).

The interaction is positive with a standardised coefficient of 0.183, standard error = 0.037, and $t = 4.998$. Its 95% interval ranges from 0.109 to 0.252, and $p < 0.001$. H3 is supported. This outcome suggests that the negative dependence-performance relationship weakens with the increase in diversification. The results of the hypothesis tests are reported in Table 8. Figure 2 summarises the estimated paths and explained variance: the interaction can be viewed as a conditional influence on the dependence–performance relationship.

Table 8: Structural paths and hypothesis tests

Path	β	SE	t	95% interval	p	Decision
H1 SD → BP	-0.402	0.042	9.523	-0.483 to -0.321	< .001	Supported
H2 SCD → BP	0.385	0.043	9.002	0.300 to 0.469	< .001	Supported
H3 SD x SCD → BP	0.183	0.037	4.998	0.109 to 0.252	< .001	Supported

Note: β denotes the standardised coefficient. Inference uses 10,000 valid bootstrap estimates. Main effects are conditional on the other predictor being at its mean.

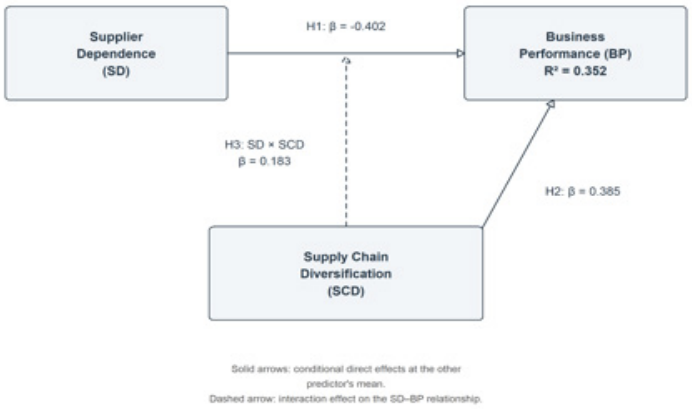


Figure 2: Estimated structural model

Explained Variance and Structural Effect Sizes

The model with the two direct predictors accounts for 31.9% of the variance in business performance (R^2 = 0.315). With the addition of the interaction, explained variance is 35.2% and the adjusted R^2 = 0.346. It has risen by 0.033 or about 3.3 per cent. Both specifications are given in Table 9. The interaction thus provides additional explanatory information to that contained in the separate relationships. The variance comparison is aligned with the proposed conditional model, and offers another way to view the contribution of moderation.

Table 9: Explained variance in business performance

Specification	R^2	Adjusted R^2	ΔR^2
Main effects	0.319	0.315	—
Main effects plus interaction	0.352	0.346	0.033

The values of the effect size estimates are 0.248 for supplier dependence, 0.228 for diversification and 0.051 for the interaction. The two direct relationships are of medium size and the interaction relationship is of small size, according to the conventional interpretation, which was adopted in the results. Included and excluded model comparisons are provided in table 10. Thus, the incremental contribution of statistical support for moderation is smaller than either of the direct predictors. This separation promotes an understanding of the role of buffering that does not suggest that it is sufficient on its own to explain everything (Fang, Yu, *et al.*, 2024).

Table 10: Structural effect sizes

Path	R^2 included	R^2 excluded	f^2	Magnitude
SD → BP	0.352	0.192	0.248	Medium
SCD → BP	0.352	0.205	0.228	Medium
SD x SCD → BP	0.352	0.319	0.051	Small

Conditional Effects of Supplier Dependence

The moderation analysis is best understood from the conditional slope analysis. The dependence-coefficient is −0.598 at the level of low diversification (1 SD below the mean). It is −0.402 at average diversification. When diversification is high, or 1 standard deviation above the mean, it is −0.206. The corresponding 95% intervals are −0.721 to −0.479, −0.483 to −0.321, and −0.311 to −0.107. The zero is not included in any of these three. This negative relationship consequently becomes weaker at the chosen diversification levels without losing its statistical significant from zero.

A score scale interaction coefficient of 0.196 is used for the slope calculations, and not the standardised interaction beta 0.183. Taking the score scale coefficient times the moderator value and adding it to the dependence coefficient will recreate the conditional estimates. At high diversification, the calculation is −0.402 + 0.196 = −0.206; at low diversification, it is −0.402 − 0.196 = −0.598. The reasoning behind this distinction in scaling is why the standardised beta displayed on the structural diagram does not just get plugged into the simple slope calculation (Lin *et al.*, 2021).

The absolute dependence coefficient is about 65.6% less at high diversification than at low diversification. This per cent is not a per cent improvement in business performance but describes only assimilation between the two conditional per cents. Results confirm some buffering and not elimination of exposure. In highly diversified firms, due to the presence of high diversification, a negative relationship between dependence and performance remains. In this way, diversification can

Table 11: Conditional supplier dependence effects

Diversification	Slope	SE	95% interval	p
Low (-1 SD)	-0.598	0.063	-0.721 to -0.479	< .001
Average (0 SD)	-0.402	0.042	-0.483 to -0.321	< .001
High (1 SD)	-0.206	0.052	-0.311 to -0.107	< .001

Note: Low and high levels are one standard deviation below and above mean diversification. Slopes use the score scale interaction coefficient of 0.196.

serve as an additional complement to focus on principal supplier dependence, and the rest of the adverse slope can further help with focus on difficult substitution and operational concentration (Jiang *et al.*, 2023).

Predictive Assessment

Predictive relevance values for all the business performance indicators are positive (between 0.205 and 0.274). For the benchmark, linear, the root mean squared errors are from 0.961 to 1.056 for the PLS versus 1.004 to 1.088 for the linear. For all five indicators, the PLS errors are lower. Similar patterns are seen for the mean absolute errors, which are smaller for the PLS specification across each of the outcome indicators. These comparisons and the 3200 predictions that were reported per indicator are presented in Table 12.

Table 12: Predictive assessment of performance indicators

Item	Q^2 predict	PLS RMSE	LM RMSE	PLS MAE	LM MAE
BP1	0.205	1.056	1.088	0.863	0.884
BP2	0.226	1.036	1.056	0.853	0.877
BP3	0.240	0.992	1.009	0.809	0.820
BP4	0.272	1.013	1.037	0.824	0.848
BP5	0.274	0.961	1.004	0.791	0.824

Note: LM = linear model benchmark. Each indicator has 3,200 predictions. PLS errors are lower than LM errors for all indicators.

These results suggest that the usefulness of the model lies not only with their signs and significance but also with their size. The positive values of positive predictive relevance make an improvement over the training mean benchmark, whereas the error comparisons highlight the fact that there is an advantage in the five performance indicators compared to the provided linear benchmark (Jiang *et al.*, 2023). This predictive result is in line with a model that encodes some helpful information in dependency and diversification and their relationship. These are regarded as comparative evidence, rather than a specific accuracy for all future organisational decisions, for the evaluated prediction procedure.

Integrated Interpretation and Theoretical Contribution

Results combine three related findings. Dependence is negatively related to performance, diversification is positively related to performance, and diversification alters dependence relationships. They argue as a pair that the structure of the supplier portfolio is relevant not only as a condition of the organization, but also as a context to interpret supplier reliance (Birge *et al.*, 2020). An assessment done only at the principal supplier would not capture the overall sourcing arrangement and an assessment done only at supplier breadth would not capture the ongoing significance of operational bottlenecks.

The negative path from reliance to performance provides support to the resource dependence interpretation. The indicators measure dependence and the respective problems in maintaining operations, changing suppliers and incurring switching costs (Chen *et al.*, 2022). Their link with performance is in line with the argument that access limits to alternatives can lead to a reduction in organisational discretion. But, not all close supplier relations are bad in the model. The relevant condition would be an stated problem of the organization without the main supplier, rather than length of relationship, the degree of cooperation, or volume of purchases (Khan *et al.*, 2022).

The diversification results bring to this interpretation, a capability perspective. Organisations may have active purchasing relationships on multiple sources that will offer options that will help them manage their needs. The positive direct path reflects that these sourcing arrangements are relevant at average dependence, and the interaction indicates that they also impact the outcomes of dependence (Gu *et al.*, 2022). This joint outcome provides diversification with a greater application than that of a mere replacement policy. It's part of the organisation's always-evolving purchasing configuration that alters the relationship between dependence and performance.

Both measurement and structural evidence exists to distinguish dependence and diversification. They have low HTMT ratios, suggesting that the scales contain different information, and low variance inflation factors, suggesting low amount of predictor redundancy. In principle this means that the organisation can have alternatives and remain reliant on a major supplier. That moderation result has matched with that configuration:

alternative relationships offer partial protection that doesn't render the principal relationship null and void. In this interpretation, the sourcing strategy is a more accurate description than going from concentrated purchasing to complete independence along one continuum (Liu & Park, 2021).

The results also provide insights on how management should prioritize based on statistical support. There are medium effect sizes for the direct effects and not so large effect sizes for the interaction. Through its own association with performance and through buffering, diversification is therefore relevant. A strategy focused solely on the interaction may minimize the value of basic supplier portfolio management. Likewise, if it is solely the direct positive relationship that is being read, it is ignored that dependence can occur at various stages of diversification.

Managerial Implications

It is important to assess supplier dependence in terms of critical input requirements and substitution readiness. An expenditure ranking can be helpful as background but the construct of the study focuses on the continuity of operations in the absence of the main supplier. An important supplier should be identified for each activity and an estimate made for the time it would take to replace the supplier, together with an estimate for the cost of switching to a different supplier. This assessment helps bring the dependence concept into operation and is able to differentiate between relationships that creates a special continuity exposure and commercially large relationships (Gebhardt *et al.*, 2022).

Diversification should be through active and appropriate alternatives. Organisations can examine if there are alternative suppliers who have provided the necessary inputs, met the specifications and have the necessary capacity for practical substitutions. Using sufficient dollar volume of purchases from these sources will help keep ordering and delivery processes familiar. The measured diversification practices are consistent with such arrangements, and portfolio will be more usable. The aim is to maintain viable options for workable needs while maintaining the coordination needs aligned with the business importance.

Decisions regarding procurement should also be synchronized with operations and the performance measurement. The purchasing team can look into what options are available and the operational managers can see what interruptions in an input can have on an activity to be done. Senior management can evaluate if portfolio changes are matching the target achievement and the business results. This coordination enables the meaningful organisational needs to be met through supplier diversification (Jiang *et al.*, 2023). It also allows for a selective approach to allocation of resources and focuses on the most important inputs and main relationships, which relate to the overall dependence of an organisation.

CONCLUSION

The study adopts a moderation model which introduces supply chain diversification to explore supplier dependence and business performance. 320 complete records were analyzed to help support the three proposed hypotheses. Thus, there is a negative relationship between dependence and business performance, a positive relationship between diversification and business performance, and a weaker negative dependence relationship at higher levels of diversification, as suggested by the positive interaction. The complete model accounts for 35.2% of the variance in performance and the predictive assessment provides favourable outcomes for all five indicators of performance. This regularity in the data provides a consistent pattern in measurement, explanation and prediction for comparison.

The key takeaway is that diversification will potentially mitigate the exposure of performance to the primary supplier. At low, average and high diversification, the dependence coefficient is negative, but its absolute value decreases significantly from low to high diversification degree. It is this relationality that is altered, but not departed from, with supplier breadth. This outcome reinforces a coordinated sourcing strategy, where organisations have valuable alternatives whilst evaluating the criticality, turnover and changeover cost of their primary supplier.

Organisations should start with a systematic categorisation and mapping of all the critical inputs and the suppliers who provide the critical inputs. During the review, it is important to identify what inputs are necessary to the core activities and to ascertain if there are any substitute or alternative inputs that can serve the operational needs within an acceptable time frame. The dependence should then be measured by how much the effects of the supplier loss are, not by the shares of expenditure. This is a basis for prioritizing the purchasing categories that might add the most to continuity and managerial discretion with the help of additional sources.

Purchasing activity should be undertaken to maintain appropriate alternative supply relationships by means of regular re-evaluation and open communication of requirements. Qualification process should be used to determine if sources have appropriate inputs, and practice in real transactions can maintain familiarity. Suppliers should be in a proportion appropriate to the needs of the organisation and its coordination skills. The fact that the diversification relationship will be positive from the observations, fits in with the concept of usable sourcing breadth, and the measure also fits in with identifying and managing alternatives related to the critical inputs, rather than indiscriminate expansion of vendor lists.

These sourcing decisions should be related to the organisation's goals in a Performance review. The Managers can check if the changes made to suppliers can help in better achievement of targets, expectations and continuation of the main business activities. Even when diversification is high, the current monitoring of

the principal relationship is still required as dependence is negatively linked to performance. The recommended method involves seeking out active alternatives along with continued management of operational dependence, supply source decisions as a practical part of business performance management.

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