

Sales of Ferrous and Non-Ferrous Metals in Indian Markets: Some Supply Chain Issues

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Abstract

Supply chain management embodies the complete synchronization of the business functions in an organization. It also involves the strategy across these business functions within a particular business and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole⁷. Metal supply chains involves another peculiarity as most of the companies involved are bothered more about the sales volumes rather than giving attention to the improving their supply chains. Companies in this sector often tend to give more importance to product rather than customer aspirations. In order to stay competitive a business has to strengthen its supply chain so that it adds more and more value in its offerings to the customers. This is even more important as customers are increasingly demanding more value in the product they buy. This has led the businesses to make their supply chains flexible and responsive.

Keywords: Factor Analysis, Ferrous Metals, Metal Supply Chain, Non-Ferrous Metals, Sales, Strategy

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1. Introduction

In today's global business environment, innovation is an extreme sport, where teammates, opponents, the playing field, and the rules of the game change all the time¹⁵. If organizations are open to innovations then they must identify each and every rudiment of their supply chain and innovate on them. According to Handfield et al.³, as organizations move toward customer-driven network situations, the coordination of decisions throughout the chain becomes vital for success.

The supply chain has three parts: upstream, internal and downstream. If the rudiments of these parts are addressed as per the customer needs, then value would definitely be created and thus business objectives achieved. The paper attempts to look into the perception of stakeholders on metal supply chain elements for sales of ferrous metals, non-ferrous metals in India. A questionnaire containing questions about the sales of ferrous metals, non-ferrous metals in India was administered to stakeholders in order to reveal the importance of rudiments of the metal supply chain that affects the sales.

2. Review of Literature

Prior to the 1980s, marketing was viewed as a mere sales order taking activity and has grown to be recognized as a critical

function that links customer needs with internal business planning³. As per Gattorna et al.² many organizations operate improper structures and are unable to identify the needs of the marketplace and the unconventional behavior of their own customers. The need for the metal industry is to make their supply chains flexible and responsive. Schorch¹⁰ made two comments for the steel industry- firstly that "a tonnage mentality exists within most steel companies, encouraging managers to focus on sales volume rather than on profitability and customer needs; and secondly that the industry continues to segment its market by product and/or industrial sector rather than by customer buying factors. Williams et al.¹⁶ found out that both competent sales efforts and technological support are important for enhancing sales. One efficient way to develop a differentiated SC strategy could be to combine different supply, manufacturing and distribution strategies into various SC solutions⁸. Litz and Rajaguru⁵ provided specific guidance as to the type of location small firms might seek out - specifically, easily accessible positions at close distance to stable customers. Mc Adam and Brown⁶ conducted an exploratory study on strategic alignment within the steel stakeholder supply chain. According to them, disjointed and unpredictable nature of this sector puts pressure on the organizations. The need is to align all rudiments of the supply chain to ensure responsiveness. Thatte et al.¹² conducted a study on supply chain responsiveness and a firm's practices to respond to customer's demand and rapidly

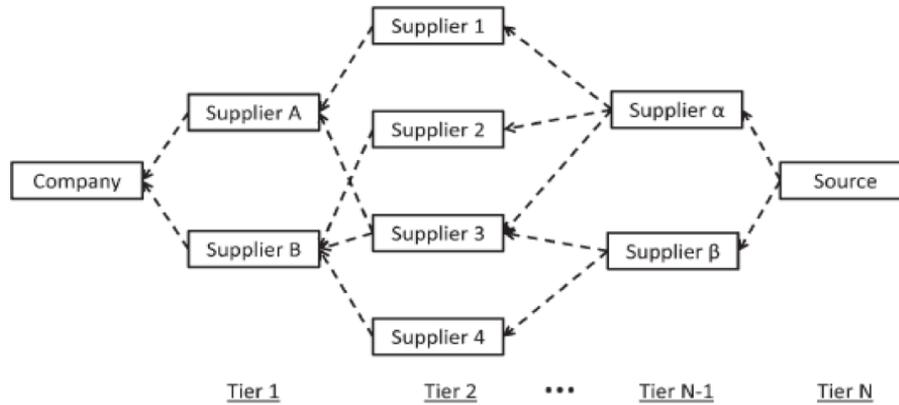


Figure 1. A diamond-shaped supply chain.

Source: Slowinski et al.¹¹

changing market conditions and recommended that there is a need to study supply chain issues at the supply chain level in order to achieve competitive advantage.

According to Rauer and Kaufmann⁹, there are 10 tier stages along a metals supply chain, ranging from original mining of metals, over metal melting processes, to the sales of metals through myriad spot markets. As per Slowinski et al.¹¹, “Diamond shaped supply chains occur when a firm uses multiple tier 1 suppliers who in turn use a limited number of tier 2 suppliers, who all use the same source. From the firm’s point of view, the supply chain may appear to be composed of a diverse set of suppliers, often in different countries. However, the reality is that one firm, or a limited number of firms, provides critical materials to all the suppliers. The critical metal supply chain has this shape; in the case of several critical metals, the supplier is located in China”. The supply chain of ferrous and non ferrous metals does not differ too much for this, this has happened due to the increased multinational role of Indian companies.

In US, partnerships are made between THE National Association of Aluminum Distributors (NAAD) and Metal Spectrum (an online marketplace for specialty metals) so that members expand their business and become more profitable. It was aimed to better serve customers. Another aim was to reach all levels of the specialty metal supply chain¹. The competition has intensified for the metal sector. There are increased customer demands that include standards of costs and quality. In a supply chain that has changed markedly, organizations need to clearly identify their market and adopt proper strategies⁶. Other studies propose that synergies exist when improved integration occurs across customers and suppliers³.

The supply chain can be broadly classified into three parts: upstream, internal and downstream^{13,14}. Firstly, *Upstream*

Supply Chain that is mainly concerned with procurement of raw materials. It includes suppliers that could be manufacturers themselves. Major activities in this part of the supply chain are purchasing and shipping. Secondly, *Internal Supply Chain* that is mainly concerned with transforming the inputs obtained in upstream supply chain into outputs. In this part the major activities are material handling, inventory management, manufacturing and quality control. Finally, there is *Downstream Supply Chain* that is mainly concerned with the processes involved in delivering the finished products from internal supply chain to final customers. In this part the major activities are packaging, warehousing and shipping. For these activities many wholesalers and distributors are involved. The last three sections of the questionnaire of this paper address towards these issues.

There is a paucity of research in this area in steel stakeholder supply chain⁶ and in general in the metal supply chain.

3. Research Methodology

Primary data has been collected from the, in the following sections:

- A. *Personal Factors.*
- B. *Miscellaneous.*
- C. *Product Differentiation.*
- D. *Economic Reasons.*
- E. *Location Reasons.*
- F. *Reasons due to Inbound Supply Chain.*
- G. *Reasons due to Internal Supply Chain.*
- H. *Reasons due to Outbound Supply Chain.*

Legend:

B1	The company is growing and business environment is good.
B2	Ferrous/Non ferrous material is an essential input as raw material.
B3	Ferrous/Non ferrous Metal Industry has good market reputation including their sales staff.
B4	Supplier company is providing you all type of technical support.
C1	Cost of the product.
C2	Quality of the product.
C3	Innovation and design of the product.
C4	Features of the product.
C5	Value of the product.
C6	Any other criteria, Please mention.
D1	Discounts given on the MRP of the product.
D2	Discounts on End of month/quarter/year end.
D3	Credit facility/Channel financing is arranged by metal company.
E1	Delivery location.
E2	Time lag in distribution and time of actual order.
E3	Warehousing location that stores products from manufacturer.
F1	Manufacturer's procurement profile.
F2	Manufacturer's country of origin.
F3	Manufacturer's economic condition.
F4	Amount of money the manufacturer spends on research.
G1	Process of manufacturing of the product.
G2	Quality assurance of the product.
G3	Product Configuration.

G4	Technology and allied issues.
H1	After Sales Service, Guarantee and technical support.
H2	Unconditional return of the product, in case defective.
H3	Incentives like quantity /loyalty discount or credit notes as % for total purchase value.
H4	Free transportation and free unloading or loading charges.

4. Data and Data Sources

4.1 Analysis

From many existing data analysis methods exploratory data analysis method was found suitable for this analysis. For exploratory data analysis, factor analysis has been used. This analysis is used to study correlations among a large number of interrelated variables. The variables are grouped into factors and the variables within a factor show higher correlations. A factor analysis was carried out on the sections B to H and then the meaning of each factor was interpreted to comment on the customer's perception about the sales of ferrous and non ferrous metals in India.

The Kaiser-Meyer-Olkin measure of sampling adequacy, KMO statistic is 0.642, which means we can conclude that the degree of common variance among the variables is tolerable and the factors extracted will account for fare amount of variance.

Communalities, which are the proportion of the total variance of a variable accounted for by the common factors in a factor analysis, were calculated. All the variables have communality above 0.478 with B3 having the highest communality (0.846) followed by C2 (0.829) and B1 (0.820). G4 has the lowest

Table 1. Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.454	15.907	15.907	4.454	15.907	15.907
2	2.858	10.208	26.115	2.858	10.208	26.115
3	2.085	7.448	33.563	2.085	7.448	33.563
4	1.728	6.172	39.735	1.728	6.172	39.735
5	1.576	5.629	45.363	1.576	5.629	45.363
6	1.442	5.149	50.512	1.442	5.149	50.512
7	1.298	4.637	55.149	1.298	4.637	55.149
8	1.267	4.525	59.675	1.267	4.525	59.675
9	1.200	4.287	63.962	1.200	4.287	63.962
10	1.069	3.818	67.779	1.069	3.818	67.779
11	1.006	3.593	71.373	1.006	3.593	71.373

Table 2. Component Matrix^a

	Component										
	1	2	3	4	5	6	7	8	9	10	11
B1	.858	-.167	-.089	-.026	.055	.007	-.159	.042	-.098	.042	.080
B2	.372	.708	-.103	-.113	-.063	-.011	-.024	.033	.004	.091	-.331
B3	-.165	.055	.855	.213	-.056	.097	.003	.101	.049	.041	.114
B4	-.085	-.178	-.095	-.102	-.030	.010	.530	-.333	.331	.068	.349
C1	.857	-.199	-.012	-.010	.035	-.033	-.124	.027	-.185	.027	.181
C2	.847	-.246	.135	-.070	-.112	-.021	.041	-.016	.096	-.022	-.061
C3	.289	.875	-.024	-.089	-.041	.016	.020	.069	.031	-.022	-.084
C4	.244	.575	-.017	-.102	-.001	.034	-.014	-.124	.042	-.149	.485
C5	.792	-.188	.168	-.056	-.067	.000	.147	-.025	.227	-.003	-.157
C6	.561	-.084	.138	.090	-.042	.028	.210	-.338	.070	.108	-.296
D1	.855	-.259	-.039	.021	.018	-.029	-.120	-.020	-.217	-.026	.208
D2	.270	.817	-.090	-.101	-.064	-.030	.108	.098	-.074	-.016	-.013
D3	-.043	.172	.882	.190	.014	.033	-.120	-.025	-.075	.072	.086
E1	.074	.236	-.091	.658	-.138	-.196	-.164	-.113	.186	-.033	.013
E2	.015	-.002	-.120	.610	.015	.248	-.139	-.233	.154	.174	-.086
E3	.211	.123	.056	.428	.034	-.483	-.100	-.075	.331	-.256	.078
F1	-.088	-.064	.141	-.255	.449	-.070	-.121	-.365	-.215	.104	.085
F2	.197	-.158	-.091	.024	.043	.591	.013	-.024	.116	-.352	-.202
F3	.067	-.107	-.299	.220	.110	.201	-.196	.441	.217	-.173	.325
F4	.135	.104	.020	.266	.231	-.163	.500	.227	-.411	-.267	.078
G1	.100	-.057	.180	.137	.573	-.152	.438	.317	.037	-.036	-.111
G2	.002	.000	-.222	.320	.624	.051	.046	-.104	.017	.033	-.214
G3	.073	.201	-.091	-.014	.061	.510	.302	.107	.310	.202	.184
G4	.139	-.026	.121	-.263	-.009	-.350	.163	.014	.411	.233	.036
H1	.203	.179	.333	-.128	.445	.373	-.263	.125	.127	.169	.035
H2	.016	.130	-.331	.073	.360	-.205	-.158	-.015	-.026	.543	.137
H3	.057	-.248	-.031	.160	-.342	-.056	.083	.590	-.027	.437	-.078
H4	.081	.118	-.057	.408	-.288	.279	.308	-.239	-.435	.259	.144

Extraction Method: Principal Component Analysis.

a. 11 components extracted.

(0.337). After analyzing the component matrix, the following factors were obtained:

A screen plot shows the sorted Eigen values, from large to small, as a function of the Eigen value index (Figure 2). Eigen value is the standardized variance associated with a particular factor. The sum of the Eigen values cannot exceed the number of variables in the analysis, since each variable contributes 1 to the

sum of variances. The screen plot helps to determine the optimal number of components.

5. Discussion

Since the data pertaining to sections is ordinal data on a five point scale, a factor analysis is applied to extract the factors that

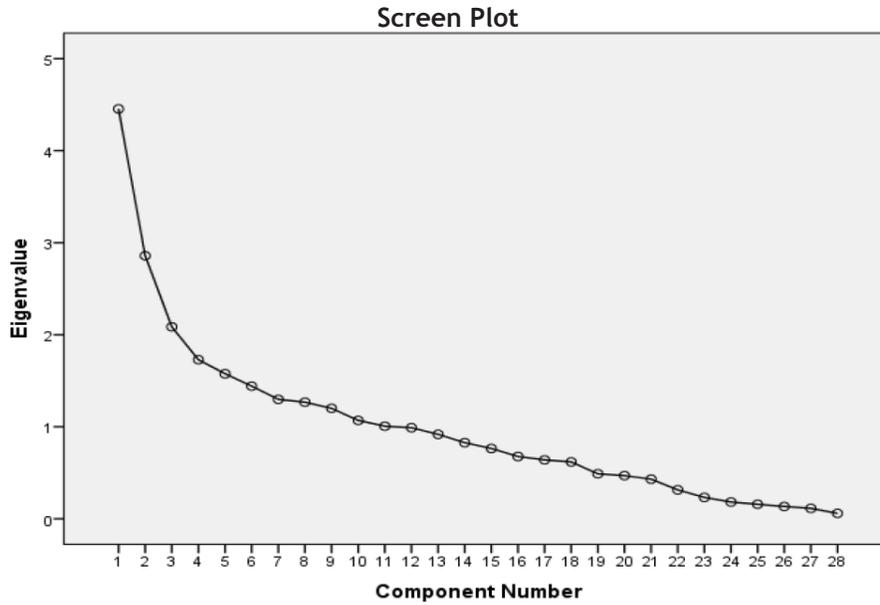


Figure 2. Screen Plot of factors.

Table 3. Ferrous/Non Ferrous Metal Comparison

Factors	Description
1	The company is growing and business environment is good (B1), Cost of the product (C1) 1 Quality of the product (C2), Value of the product (C5), Discounts given on the MRP of the product (D1). 1
2	Ferrous/Non ferrous material is an essential input as raw material (B2), Innovation and design of the product (C3), Features of the product (C4), Discounts on End of month/quarter/year end (D2).
3	Ferrous/Non ferrous Metal Industry has good market reputation including their sales staff.(B3) 3 Credit facility/ Channel financing is arranged by metal company (D3).
4	Delivery location(E1), Time lag in distribution and time of actual order (E2), Warehousing location that stores products from manufacturer (E3), Free transportation and free unloading or loading charges (H4).
5	Manufacturer’s procurement profile (F1), Process of manufacturing of the product (G1), Quality assurance of the product (G2), After Sales Service, Guarantee and technical support (H1).
6	Manufacturer’s country of origin (F2), Product Configuration (G3).
7	Supplier company is providing you all type of technical support (B4), Amount of money the manufacturer spends on research (F4).
8	Manufacturer’s economic condition (F3), Incentives like quantity/loyalty discount or credit notes as % for total purchase value (H3).
9	Technology and allied issues (G4).
10	Unconditional return of the product, in case defective (H2).

explain the critical variables. The 11 factors extracted are explaining more than 70% of the variance. Given below is a description of the factors and the variables embedded in them.

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Conflict of Interest:

Author of a paper had no conflict neither financially nor academically

Appendix 1

Table 1. Perceptions of the respondents on Miscellaneous (Section B)

		Count	Sub table N %
B1	Strongly disagree	6	4.9%
	Disagree	19	15.6%
	Neutral	32	26.2%
	Agree	32	26.2%
	Strongly Agree	33	27.0%
B2	Strongly disagree	3	2.5%
	Disagree	17	13.9%
	Neutral	35	28.7%
	Agree	41	33.6%
	Strongly Agree	26	21.3%
B3	Strongly disagree	3	2.5%
	Disagree	35	28.7%
	Neutral	27	22.1%
	Agree	35	28.7%
	Strongly Agree	22	18.0%
B4	Strongly disagree	33	27.0%
	Disagree	40	32.8%
	Neutral	22	18.0%
	Agree	18	14.8%
	Strongly Agree	9	7.4%

Table 2. Perceptions of the respondents on Economic reasons (Section D)

		Count	Sub table N %
C1	Strongly disagree	3	2.5%
	Disagree	13	10.7%
	Neutral	33	27.0%
	Agree	38	31.1%
	Strongly Agree	34	27.9%
C2	8.0	1	0.8%
	Strongly disagree	5	4.1%
	Disagree	9	7.4%
	Neutral	20	16.4%
	Agree	47	38.5%
C3	Strongly Agree	41	33.6%
	Strongly disagree	6	4.9%
	Disagree	14	11.5%
	Neutral	38	31.1%
	Agree	29	23.8%
C4	Strongly Agree	35	28.7%
	Strongly disagree	5	4.1%
	Disagree	12	9.8%
	Neutral	40	32.8%
	Agree	25	20.5%
C5	Strongly Agree	40	32.8%
	Strongly disagree	6	4.9%
	Disagree	8	6.6%
	Neutral	23	18.9%
	Agree	44	36.1%
C6	Strongly Agree	41	33.6%
	Strongly disagree	5	4.1%
	Disagree	11	9.0%
	Neutral	19	15.6%
	Agree	40	32.8%
	Strongly Agree	47	38.5%

Table 3. Perceptions of the respondents on location reasons (Section E)

		Count	Sub table N %
D1	Strongly disagree	4	3.3%
	Disagree	11	9.0%
	Neutral	35	28.7%
	Agree	36	29.5%
	Strongly Agree	36	29.5%
D2	.0	2	1.6%
	Strongly disagree	5	4.1%
	Disagree	13	10.7%
	Neutral	36	29.5%
	Agree	28	23.0%
	Strongly Agree	38	31.1%
D3	Strongly disagree	3	2.5%
	Disagree	40	32.8%
	Neutral	23	18.9%
	Agree	36	29.5%
	Strongly Agree	20	16.4%

Table 4. Perceptions of the respondents on product differentiation (Section E)

		Count	Sub table N %
E1	Strongly disagree	47	38.5%
	Disagree	34	27.9%
	Neutral	23	18.9%
	Agree	10	8.2%
	Strongly Agree	8	6.6%
E2	Strongly disagree	7	5.7%
	Disagree	47	38.5%
	Neutral	42	34.4%
	Agree	12	9.8%
	Strongly Agree	14	11.5%
E3	Strongly disagree	10	8.2%
	Disagree	47	38.5%
	Neutral	38	31.1%
	Agree	15	12.3%
	Strongly Agree	11	9.0%
	6.0	1	0.8%

Table 5. Perceptions of the respondents on reasons due to Inbound Supply Chain (Section F)

		Count	Sub table N %
F1	Rank 1	32	26.2%
	Rank 2	29	23.8%
	Rank 3	37	30.3%
	Rank 4	24	19.7%
F2	Rank 1	37	30.3%
	Rank 2	40	32.8%
	Rank 3	23	18.9%
	Rank 4	22	18.0%
F3	Rank 1	43	35.2%
	Rank 2	26	21.3%
	Rank 3	26	21.3%
	Rank 4	27	22.1%
F4	Rank 1	32	26.2%
	Rank 2	28	23.0%
	Rank 3	29	23.8%
	Rank 4	33	27.0%

Table 6. Perceptions of the respondents on reasons due to internal Supply Chain (Section G)

		Count	Sub table N %
G1	Rank 1	34	27.9%
	Rank 2	26	21.3%
	Rank 3	29	23.8%
	Rank 4	33	27.0%
G2	Rank 1	33	27.0%
	Rank 2	32	26.2%
	Rank 3	26	21.3%
	Rank 4	31	25.4%
G3	Rank 1	28	23.0%
	Rank 2	33	27.0%
	Rank 3	33	27.0%
	Rank 4	28	23.0%
G4	Rank 1	30	24.6%
	Rank 2	29	23.8%
	Rank 3	35	28.7%
	Rank 4	28	23.0%

Table 7. Perceptions of the respondents on reasons due to outbound Supply Chain (Section H)

		Count	Sub table N %
H1	Rank 1	26	21.3%
	Rank 2	29	23.8%
	Rank 3	43	35.2%
	Rank 4	24	19.7%
H2	Rank 1	21	17.2%
	Rank 2	32	26.2%
	Rank 3	31	25.4%
	Rank 4	38	31.1%
H3	Rank 1	35	28.7%
	Rank 2	28	23.0%
	Rank 3	27	22.1%
	Rank 4	32	26.2%
H4	Rank 1	23	18.9%
	Rank 2	37	30.3%
	Rank 3	27	22.1%
	Rank 4	35	28.7%