Appendix 1

First Version of Main Survey Questionnaire[1]

Section A

Name:

Email id:

Designation:

Basic Function:

Name of the Organization:

Division/Department/Group:

Age:

Experience:

Qualification:

Serving this organization since ---

Number of organizations worked earlier:

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[1] This questionnaire has 163 questions (chosen from the literature on OI) given in 1 to 7 scales. This is the first version. Some questions that fetched similar variables are removed in the next version presented in Appendix 2

Perceived Organizational Profile

Section B

Dear Respondent,

This is a perceptional study. The questionnaire is prepared to your personal perceptions about your organization. The entire personal profile and organizational information are used only for research purposes and will be kept confidential. It will take 45 minutes to complete answering the questions. You are expected to rank your understandings and perceptions of your organization from 1 to 7.

Item No	Profile Items	Most Characte--ristic			Neutral	Least Characte--ristic		
		7	6	5	4	3	2	1
I	*ORGANIZATIONAL LEARNING, CULTURE & LEADERSHIP CHARACTERESTICS*							
1	Capacity for Directing the organization towards goal							
2	Capacity to encourage innovation and creativity							
3	Capability to communicate organizational values to stakeholders							
4	Interest and Ability to motivate employees for two way communication							
5	Capability to encourage organizational learning continuously							
6	Capability to encourage employee learning							
7	Capability to stay ethical while making decisions							

8	Capacity to take responsibility and accountability for their actions and decisions							
9	Ability to protect the interest of stakeholders							
10	Capacity in judging the performance of organization							
11	Capacity to judge the employee capabilities							
12	Capacity to assess the need of the organization							
13	Capability to set goals of short and long term							
14	Capability to assess organizational needs							
15	Capability to set precise Key Performance Assessment measures for employees							
16	Capability to incorporate Findings of the employee Performance into practice							
17	Ability to create & deploy opportunities for innovations in business Processes							
18	Interest & willingness of leaders to improvise and enhance leadership skills							
19	Interest of leaders to understand the impact of the products and services on society							
20	Ability of Leaders to hold compliance processes, measures and goals							
21	Interest of leaders to understand Public concerns of business operations of the organization							
22	Ability of leaders to stay proactive to sense the opinions and concerns of society							
23	Interest of organization to promote ethical behavior among stakeholders							
24	Availability of frameworks and processes to execute actions with ethics inside organization							
25	Level of Moral support from leaders to be ethical in business dealings							
26	Cordial relationships between							

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	employees and leaders						iv	
27	Cordial friendship between peers							
28	Interest level of employees to help each other on personal levels							
29	Communication & Networking abilities of Employees							
30	Power difference between employees affecting decision making							
31	Ability of employees to handle uncertain scenarios while making decisions							
32	Ability of organization to achieve goals collectively							
33	Ability of organization to meet the challenges and crisis							
34	Ability of organization to orient its cultural dynamics towards the organizational Goal							
35	Competency of organization to educate Employees and train to contribute to the achievement of action plans							
36	Competency of organization to educate and train employees and address key needs associated with organizational performance measurement, performance improvement and technological change							
37	Competency of organization to balance short and long term organizational objectives with employee needs for development, learning and career progression							
38	Competency of organization to manage employee education, training, development, new employee orientation, and leadership development effectively							
39	Competency of organization to seek and use input from employees and their supervisor and managers on education ad training needs							
40	Competency or organization to incorporate organizational learning and knowledge assets into employee							

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	education and training						v	
41	Competency of organization to use both formal and informal delivery approaches, including mentoring							
42	Competency of organization to reinforce the use of new knowledge and skills of employees on the job							
43	Competency of employees to evaluate the effectiveness of education and training, taking into account individual and organizational performance							
44	Competency of organization to motivate employees to utilize their full potential							
45	Competency of organization to help employees attain job and career related development and learning objectives							
46	Competency of organization to use formal and informal mechanisms in doing the same							
47	Competency of organization to identify current level and trends in key measures of employee learning and development							
48	Competency of organization to identify current levels and trends in key measures or indicators of employee well being, satisfaction, and dissatisfaction							
49	Capability of organization to identify and discuss current findings and trends in key measures of indicators of fiscal accountability internal and external							
50	Capability of organization to identify and discuss current findings and trends in key measures or indicators of ethical behavior and of stakeholder trust in the governance of organization							
51	Capability of organization to analyze results of key measures or indicators of regulatory and legal compliance							
52	Capability of organization to results for key measures or indicators of organizational							

A-1	citizenship in support of communities						
II	*STAKEHOLDER RELATIONSHIPS*						
53	Ability of organizations to build relationships with customers						
54	Capacity of organizations to have provisions for customers to seek information, conduct business and make complaints etc (e.g., through websites etc)						
55	Capacity of organizations to define key requirements to identify customer contact for every mode of access and deploy it effectively						
56	Competency of organization to ensure that the customer complaints are solved effectively and promptly						
57	Interest of organization to aggregate and analyze the complaints of customers for process improvements						
58	Competency of organization to determine the satisfaction and dissatisfaction of customers						
59	Ability of organization to design and possess a scale to measure actionable information from customers						
60	Ability of organizations to absorb and benchmark itself with the best practices of industry						
61	Interest of organization to compare And contrast the best practices Against customer satisfaction and organizational goals						
62	Competency of organization to maintain work environment and employee support climate that contributes to the well-being, satisfaction and motivation of all employees						
63	Capability of organization to improve workplace health, safety, security and ergonomics						
64	Capability of organization to make employees take part in improving workplace and environmental health						
65	Capacity of organization to measure performances or targets for each of these key workplace factors						

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66	Capacity of organization to ensure business continuity for the benefit of employees and customers							
67	Capability or organization to determine the key factors that affect employee well-being, satisfaction, and motivation							
68	Capability or organization to support employees via services, benefits and policies							
69	Competency or organization to determine the formal and informal assessment methods and measures to assess employee well being and motivation							
70	Capability of organization to relate assessment findings to key business results to identify priorities for improving employee support climate and work environment							
71	Competency of organization to identify key customer- focused results, including customer satisfaction and customer perceived value							
72	Competency of organization to Identify current levels and trends in key measures or indicators of customer satisfaction and dissatisfaction							
73	Capacity of organization to compare with competitors' levels of customer satisfaction							
74	Capacity of organization to identify current levels and trends in key or indicators of customer perceived value, including customer loyalty and retention, positive referral and other aspects of building relationships with customers							
III	STRATEGY PROCESSES (FORMULATION & DEPLOYMENT)							
75	Ability for being dynamic in preparing strategic plans							
76	Capacity of Organization to decide key roles and responsibilities for execution of action plans							
77	Capability of organization to plan short							

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A-1	and long term goals and foresee the execution time well in advance						viii
78	Capacity of Organization to identify the constraints and critical success factors for the strategic plans						
79	Capacity of organization collect data and analyze or strategic planning process						
80	Ability of organization to collect complete details on customers, market, competitors and the utilize them to deploy opportunities						
81	Capability of organization to incorporate the skills and strengths of competitors in strategic planning process						
82	Capability of organization to incorporate technological changes and innovations in planning process						
83	Competency of organization to measure and assess all the resources for efficient deployment of the planning						
84	Competency of organization in prioritizing the activities direct its resources accordingly						
85	Competency of organization to identify and measure changes in national and global economy for strategic planning process						
86	Competency of organization to find balance between short and long term goals						
87	Ability of organization to strike a balance between the goals of the organization and needs of stakeholders						
88	Competency of organization to track the progress of action plans						
89	Competency of organization to assess and compare the performances with competitors periodically and incorporate the results in strategic plans						
IV	*INFORMATION & KNOWLEDGE ASSETS MANAGEMENT*						

90	Competency of organization to select, collect, align and integrate data and information for tracking daily operations and for tracking overall organizational performance						ix	
91	Competency of organization to use these data and information to support organizational decision making and innovations							
92	Competency of organization to perform organizational performance review to support strategic planning process							
93	Competency of organization to communicate results of organizational level analyses to work group and functional level operations to enable effective support for decision making							
94	Competency of organization to ensure the quality, availability and accessibility of information for employees, suppliers, partners and customers							
95	Competency of organization to build and manage its knowledge assets							
96	Competency of organization to make the information available continuously without any disruptions							
97	Competency of organization to ensure the knowledge and information infrastructure secured, stable and user friendly							
98	Competency of organization to keep up the state of the art knowledge available to employees are in the same directions of organizational objectives							
99	Competency of organization to collect, organize and manage knowledge of best practices and benchmarks effectively across all stakeholders							
100	Competency of organization to ensure security, timeliness, integrity, accuracy, confidentiality and reliability of its knowledge and information assets							

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#	Description							
101	Ability of organization to determine target customers, groups and market segments precisely						x	
102	Ability of organization to include, customers of potential competitors, prospective customers and markets in this determination							
103	Ability of organization to create market for its products and services							
104	Ability of organization to identify customer expectations and requirements and understand their relationship with buying decisions							
105	Ability of organization to collect customer related information and use it for process improvements and business development activities and marketing							
106	Ability of organization to keep employee learning aligned with business needs and directions							
V	*FINANCIAL PERFORMANCE & MARKET SHARE*							
107	Capacity of organization to identify current levels and trends in key measures or indicators of financial performance, including aggregate measures of financial return and economic value							
108	Capacity of organization to identify current levels and trends in key measures or indicators of market place performance, including market share position, business growth, and new markets entered							
VI	*ORGANIZATIONAL SYSTEMIC EFFICIENCY*							
109	Competency of organization to organize and manage work and jobs to promote cooperation, initiative and empowerment for effective decentralized decision making							
110	Competency of organizations to have systematic frameworks to achieve agility to keep up the pace							

A-1	of changes in business needs and the business environments						xi
111	Competency of organizations to achieve effective communication and skill sharing across work units, jobs and locations						
112	Capacity of organization to maintain and manage sustainable employee performance management system						
113	Capability of organization to identify and shape up the potentials and skills of employees and utilize them effectively to improve the efficiency of work systems						
114	Capability of organization to plan, recruit and retain skilled employees						
115	Capability of organization to have successor planning in place for key lead positions						
116	Capability of organization to support employees to have right career path and goals and manage a fruitful career while working in the organizations						
117	Capacity of organization to maintain positive progress of career for senior as well junior and middle management employees						
118	Competency of organization to identify current levels and trends in key measures of employee learning and development						
119	Competency of organization to identify current levels and trends in key measures or indicators of the operational performance of key value creation processes						
120	Competency of organization to identify and include productivity, cycle time, supplier, and partner performance for measuring organizational effectiveness						
121	Capability of organization to identify current levels and trends in key measures of indicators of the operational performance of key business processes						
122	Capability of organization to include						

A-1	the measures of organizational effectiveness in measuring the operational efficiency of business processes						
123	Capability of organization to analyze results of key measures of indicators of accomplishment of organizational strategy and action plans for organizational improvement						
VII	*BUSINESS PROCESS EFFICIENCY*						
124	Competency of organization to identify and manage its key processes for creating customer value and achieving business success and growth						
125	Competency of organization to determine its key value creation processes						
126	Capability of organization to know these processes that create value for organization, customers and other key stakeholders						
127	Capability or organization to identify value creating processes that contribute to profitability and business success						
128	Competency of organization to determine key value creation process requirements, incorporating input from customers, suppliers and partners						
129	Competency of organization to determine and design these processes to meet all the key requirements						
130	Ability of organizations to incorporate new technology and organizational knowledge into the design of these processes						
131	Capacity of organization to implement processes to ensure that they meet design needs						
132	Capacity of organization to ensure day to day operation of these processes to meet key process requirements						
133	Capability of organization to						

A-1	prevent defects and rework, and minimize warranty costs							
134	Capacity of organization to minimize overall costs associated with inspections, tests and process performance audits							
135	Competency of organization to improve value creation processes to achieve better performance, to reduce variability, to improve products and services, in tandem with changing business needs and directions							
136	Capacity or organization to share improvements with other organizational units and processes							
137	Capacity of organization to manage its key processes that support the value creation process							
138	Capacity of organization to determine its key processes that add weight-age to value creating processes							
139	Capability of organization to determine key process requirements, incorporating input from internal and external customers, and suppliers and partners							
140	Capabilities of organizations to design these processes to meet all the key requirements							
141	Competency of organization to incorporate new technology and organizational knowledge into the design of these processes							
142	Competency of organization to incorporate cycle time, productivity, cost control and other efficiency, and effectiveness factors into the design of the processes							
143	Competency of organizations to implement processes to ensure the meeting of design requirements							
144	Capacity of organization to determine key performance measures or indicators used for the control and improvement of these processes							
145	Capacity of organization to determine							

A-1	day-to-day operation of the key processes and ensure the meeting of key performance requirements						
146	Capacity of organization in using process measures to manage processes effectively						
147	Capacity of organization in using the input from customer, supplier and partner in managing these processes						
148	Capacity of organization to minimize overall costs associated with inspections, test and process or performance audits						
149	Capacity of organization to prevent defects and rework in process performances						
150	Capacity of organizations to improve processes to achieve better performances to reduce variability, and to keep up with changing business trends						
151	Capacity of organizations to share improvements with other organizational units and processes						
VIII	*PRODUCT QUALITY & SERVICE PERFORMANCE*						
152	Capacity of organization to identify current levels and trends in key measures or indicators of product and service performance that are important to customer						
153	Capacity of organization to compare these results with competitor's performance						
154	Capacity of organization to implement total quality management effectively in production processes						
155	Capacity of organization effectively managing quality improvement programs in business processes leading to services						
156	Capacity of organization to upgrade the quality improvement processes and implement them in various business processes						
157	Capacity of organization to identify suitable quality improvement programs						

A-1	and manage them efficiently						xv	
158	Capacity of organization to use Continuous improvement of quality methods and bench mark the processes for future							
159	Capacity of organization to identify and formulate best practices and implement them to improve product/service quality							
160	Capacity of organization to have scales and measurements for measuring product/service quality at every stage of the value chain							
161	Capacity of organization to effectively use the results of quality measurements in tightening the quality improvement programs and other business processes							
162	Capacity of organizations to monitor quality continuously							
163	Interest and efforts of organization to have error free mechanisms and security processes for quality in services and products							

Appendix 2

Second Version of Main Survey Questionnaire[1]

Section A

Name:

Email id:

Designation:

Basic Function:

Name of the Organization:

Division/Department/Group:

Age:

Experience:

Qualification:

Serving this organization since ---

Number of organizations worked earlier:

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[1] This is the second version of the questionnaire having 153 questions after removing similar variables designed in 1 to 5 scales. This is once again refined on the advices of senior executives of business corporations and then they are confirmed by literature. The refined version has 40 questions listed in Appendix 3

Perceived Organizational Profile

Section B

Dear Respondent,

This is a perceptional study. The questionnaire is prepared to your personal perceptions about your organization. The entire personal profile and organizational information are used only for research purposes and will be kept confidential. It will take 45 minutes to complete answering the questions. You are expected to rank your understandings and perceptions of your organization from 1 to 7.

Item No	Profile Items	Most Characte--ristic		Neu--tral	Least Characte--restic	
		5	4	3	2	1
I	ORGANIZATIONAL LEARNING, CULTURE & LEADERSHIP CHARACTERESTICS					
1	Interest and focus of leaders to link business activities with goals					
2	Interest and plans of leaders in encouraging innovation and creativity in business process, activities, solutions, products and services					
3	Interest and Ability of leaders to communicate organizational values to stakeholders					
4	Interest and Ability of leaders to motivate employees for two way communication					
5	Interest of leaders in encouraging organizational learning as a whole					
6	Interest of leaders in encouraging employee learning					

7	Extent of leaders being ethical while making decisions					
8	Capacity of leaders to take responsibility and accountability for their actions and decisions					
9	Capacity of leaders to protect the interest of stakeholders					
10	Capacity of leaders in judging the performance of organization					
11	Capacity of leaders to judge the employee skills and capabilities					
12	Capacity of leaders to assess the need of the organization					
13	Capability of leaders to set goals of short and long term					
14	Capability of leaders to assess the business needs of business units of the organization					
15	Capability of leaders to set precise Key result area measures for employees					
16	Interest of leaders to incorporate the findings of the employee performance into practice					
17	Capacity of business units to create & deploy opportunities for innovations in business Processes					
18	Interest & willingness of leaders to improvise and enhance leadership skills					
19	Interest of leaders to understand the impact of the products and services on society					
20	Ability of Leaders to hold compliance process measures and goals					
21	Interest of leaders to understand concerns of public towards the business activities of the organization					
22	Ability of leaders to stay proactive to sense the opinions and concerns of society about organization, its products and services					
23	Interest of organization as a whole to promote ethical behavior among stakeholders					
24	Availability of concrete frameworks and processes to execute actions with ethics inside organization					

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25	Moral support from leaders to stay ethical in business dealings				iv	
26	Cordial relationships between employees and leaders					
27	Cordial friendship between peers and junior employees					
28	Interest level of employees to help each other on personal levels					
29	Communication & Networking abilities of Employees					
30	Absence of Power difference between employees affecting decision making					
31	Ability of employees to handle uncertain scenarios while making decisions					
32	Ability of organization to achieve goals together collectively					
33	Ability of business units / organization to meet the challenges and unexpected crisis					
34	Interest of leaders to guide and educate employees towards the achievement of their action plans					
35	Level of employee training and development programs directed towards performance improvement and technological change					
36	Competency of organization to balance short and long term organizational objectives along with employee needs for development, learning and career progression					
37	Interest of organization to orient new employees towards organizational values and culture and develop them as leaders					
38	Interest of leaders to seek inputs from employees for business benefits					
39	Presence of laid down Processes and methods to incorporate organizational learning and knowledge for improvement of products, services and cultural dynamics					
40	Interest of Leaders to act as the mentors for the potential leaders inside the organization					

41	Ability of leaders to motivate employees to utilize their full potential on job				✓	
42	Interest and ability of leaders to help employees attain job and career related development and learning objectives					
43	Interest of leaders to set key measures to identify current level and trends of employee learning and self development and their well being					
44	Interest of leaders to set key measures to identify and nurture ethical behavior, stakeholder trust, and corporate governance of the organization					
45	Interest of leaders to have key indicators to measure the level of compliance of regulatory and legal policies					
46	Interest of leaders to show interest to support social communities and organizational citizenship towards society and country					
II	*STAKEHOLDER RELATIONSHIPS*					
47	Ability of organization to build relationships with customers					
48	Capacity of organizations to have provisions for customers to seek information, conduct business and make complaints etc (e.g., through websites etc)					
49	pacity of organizations to define key requiremer to identify customer contact for every mode of communication and deploy it effectively					
50	Competency of organization to ensure that the customer complaints are solved effectively and promptly					
51	Interest of organization to aggregate and analyze the complaints of customers for process improvements					
52	Presence of processes and scales to measure and determine the satisfaction and dissatisfaction of customers					
53	Interest and Ability of organizations to absorb and benchmark itself with the best practices of industry					

54	Interest of organization to compare and contrast the best practices against customer satisfaction and organizational goals				vi	
55	Competency of organization to maintain work environment and employee well being-support climate					
56	Interest of organization to protect health, safety and security of its employees (such as, health schemes, checkups, safety measure trainings and good ergonomic arrangements for work)					
57	Interest and ability of organization to make employees take part in improving workplace and environmental health					
58	Capacity of organization to ensure business continuity for the benefit of employees and customers					
59	Capability or organization to determine the key factors that affect employee well-being, safety, health and motivation					
60	Capability or organization to support and share profits with employees via services, benefits and policies					
61	Presence of organizational process and scales to measure the business results and employee motivational levels and the link between them					
62	Competency of organization to identify key customer- focused results (i.e to measure customer satisfaction and customer perceived value)					
63	Presence of processes and scales to measure current levels and trends of customer satisfaction and dissatisfaction and link the findings with business operations and plans					
64	Capacity of organization to compare with competitors' levels of customer satisfaction					

65	Interest and ability of organization to identify current trends of the key indicators of customer loyalty & retention, positive referral for building relationships with customers					
III	*STRATEGY PROCESSES (FORMULATION & DEPLOYMENT)*					
66	Ability of leaders in being dynamic in preparing strategic plans					
67	Ability of leaders to decide key roles and responsibilities for the execution of action plans					
68	Capability of leaders to plan short and long term goals and foresee the execution time well in advance					
69	Capacity of leaders to identify the constraints and critical success factors for the strategic plans					
70	Capacity of organization collect relevant data and analyze strategic planning process					
71	Ability of organization to collect complete details on customers, market, competitors and use them to deploy opportunities					
72	Capability of organization to incorporate the skills and strengths of competitors in strategic planning process					
73	Capability of organization to incorporate technological changes and innovations in planning process					
74	Competency of organization to measure, assess and deploy all the resources for efficient planning					
75	Competency of organization to prioritize the activities and direct its resources towards execution of action plans					
76	Presence of scales, sensors and mechanisms to identify and measure changes in national and global economy for strategic planning process					
77	Competency of organization to find balance between short and long term goals					

78	Ability of organization to strike a balance between the goals of the organization and needs of stakeholders					
79	Competency of organization to track the progress of action plans					
80	Competency of organization to assess and compare the performances with competitors and incorporate the results in strategic plans periodically					
IV	*INFORMATION & KNOWLEDGE ASSETS MANAGEMENT*					
81	Utility level of data warehouses and mining tools in the organization to select, collect, align and integrate data and sieve information by tracking daily operations					
82	Competency of organization to use Business Intelligence technology tracking overall organizational performance					
83	Competency of organization to use these data and information to support organizational decision making and innovations					
84	Competency of organization to use these data and information to support process, product and service innovations					
85	Competency of organization to perform organizational performance review to support strategic planning process					
86	Competency of organization to communicate and incorporate results of organizational level analyses to work group and functional level operations					
87	Competency of organization to ensure the quality, availability and accessibility of information for stakeholders					
88	Competency of organization to build and manage its knowledge assets					

89	Competency of organization to make the information available continuously without any disruptions					
90	Competency of organization to ensure the knowledge and information infrastructure secured, stable and user friendly					
91	Competency of organization to align employee learning in the directions of objectives					
92	Competency of organization to adapt best practices and benchmarks effectively the processes and systems across all stakeholders					
93	Organization's interest in providing Security of information and knowledge resources					
94	Organization's interest in providing timely and accurate information and knowledge resources accessibility					
95	Organization's interest in providing confidential and reliable knowledge and information resources to stakeholders					
96	Ability of organization to determine target customers, groups and market segments precisely					
97	Ability of organization to locate customers of potential competitors, its own prospective customers and available markets					
98	Ability of organization to create market for its products and services					
99	Ability of organization to identify customer expectations and requirements					
100	Ability of organizations to and understand the relationship between customer expectations and buying decisions through systematic research study					
101	Ability of organization to collect customer related information and use it for business process improvements					

102	Ability of organization to use business Intelligence information for business development and expansion and marketing its services and products				x	
V	*FINANCIAL PERFORMANCE & MARKET SHARE*					
103	Capacity of organization to identify indicators of trends of financial performance, financial return and economic value					
104	Capacity of organization to identify indicators of trends of market place performance, including market share position, business growth, and new markets entered					
105	Growth of Market share prices in the last 2 years					
106	Economic Value Analysis indicators show positive signs of growth in the last 2 years					
107	Profit growth in the last 2 years					
108	New Business verticals in the organization in the last 2 years					
109	Joint ventures and buy outs of organizations in the last 2 years leading to business development					
110	Outsourcing strategies in the organization leading to considerable cost benefits in the last 2 years					
111	Quality process implementations in the organization leading to financial business growth in the last 2 years					
VI	*ORGANIZATIONAL SYSTEMIC EFFICIENCY*					
112	Interest of organization to promote decentralized decision making through cooperation, initiative and empowerment for efficient work systems					
113	Competency of organizations to have systematic frameworks to achieve agility to keep pace with changing business needs and environments					
114	Competency of organizations to achieve effective communication and skill sharing across work units, jobs and locations					

x

115	Capacity of organization to maintain and manage sustainable work flow systems				xi	
116	Capacity of organization to maintain and manage an effective workable employee performance management system					
117	Capability of organization to identify and shape up the potentials and skills of employees and utilize them effectively to improve the efficiency of work systems					
118	Capability of organization to plan, recruit and retain skilled employees					
119	Capability of organization to have successor planning in place for key lead positions					
120	Interest of organization having a career path planning for employees					
121	Competency of organization to identify current levels and trends in key measures or indicators of the operational performance of key value creation processes					
122	Competency of organization to identify and include productivity, cycle time, supplier, and partner performance for measuring organizational effectiveness					
123	Capability of organization to sense trends operational performance of key business processes					
VII	*BUSINESS PROCESS EFFICIENCY*					
124	Presence of standards processes and usage of technology in the organization to create customer value					
125	Competency of organization determine its key value creating business processes					
126	Capability or organization to locate value creating processes that contribute to financial profitability directly					

127	Competency of organization to determine key value creation process requirements, taking inputs from customers, suppliers and partners				xii	
128	Competency of organization to determine and design these processes to meet all the key requirements specified					
129	Ability of organizations to incorporate new technology and tools with organizational knowledge into the design of these processes					
130	Capacity of organization to ensure day to day operation of these processes to meet specified stakeholder requirements					
131	Capability of organization to prevent defects and rework, and minimize warranty costs					
132	Capacity of organization to minimize overall costs associated with inspections, tests and process performance audits					
133	Competency of organization to improve value creation processes periodically resulting in better performance, variability reduction, product & service improvements					
134	Capacity or organization to share improvements with other internal units and processes					
135	Capacity of organization to manage its key processes that support the value creation process					
136	Capacity of organization to determine its key processes that add weight-age to value creating processes					
137	Competency of organization to incorporate new technology and organizational knowledge into the design of these processes					
138	Competency of organization to incorporate cycle time, productivity, cost control, efficiency, and effectiveness factors into the design of the processes					

139	Capacity of organization to determine key performance measures to control and improve business support processes				xiii	
140	Capacity of organization in using the input from customer, supplier and partner in managing business support processes					
141	Capacity of organization to minimize overall costs associated with inspections, test and process or performance audits					
142	Capacity of organization to prevent defects and rework in process performances					
VIII	PRODUCT QUALITY & SERVICE PERFORMANCE					
143	Capacity of organization to identify accurate indicators of product and service performance that are important to customer					
144	Capacity of organization to compare self performance with competitor's					
145	Capacity of organization to implement total quality management processes effectively in production processes					
146	Capacity of organization effectively managing quality improvement programs in business processes leading to services					
147	Capacity of organization to upgrade the quality improvement processes and implement them in various business processes periodically					
148	Capacity of organization to use continuous improvement of quality methods and bench mark the processes for future					
149	Capacity of organization to identify and formulate best practices and implement them to improve product/service quality					
150	Capacity of organization to have scales for measuring product/service quality at every stage of the value chain					

151	Capacity of organization to effectively use the results of quality measurements in tightening the quality improvement programs and other business processes				xiv	
152	Capacity of organizations having procedures to monitor quality continuously					
153	Interest and efforts of organization to have error free mechanisms and security processes for quality in services and products					

Appendix 3

Main Survey Questionnaire – Final Version[1]

Section A

Name:

Email id:

Designation:

Basic Function:

Name of the Organization:

Division/Department/Group:

Age:

Experience:

Qualification:

Serving this organization since --

Number of organizations worked earlier:

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[1] This is the final version of the questionnaire that is administered for data collection. The meanings of the questions and the variables that are getting collected by this final version of the questionnaire are listed in Appendix 4.

Perceived Organizational Profile

Section B

Dear Respondent,

This is a perceptional research study. The questionnaire is prepared to your personal perceptions about your organization. The entire personal profile and organizational information are used only for research purposes and will be kept confidential. It will take less than 15 minutes to complete answering all the questions. Please refer to the variable list having meanings of the terms used in this questionnaire.

Item No.	Profile Items
	ORGANIZATIONAL LEARNING & LEADERSHIP CHARACTERESTICS
1	How often decisions had been taken by business owners to change critical Business processes in last 6 months including the learning from the past? i) Between 20 and 15, or more ii) Between 15 and 10 iii) Between 10 and 5 iv) Between 5 and 0 v) Never

2	How often the needs of stakeholders and market study are being done in your business? i) Every 3 months ii) Every 6 months iii) Every year iv) Every 2 years v) Never
3	How often decisions are taken by business owners in changing the roles of employees in business based on their performance? i) Every 3 months or less ii) Every 6 months or less iii) Every year or less iv) Every 2 years or less v) Beyond 3 years
4	How many instances were there in last 3 months, where business owners had encouraged employees to innovate business processes and activities to meet business goals? i) From 15 to 20, or more ii) From 10 to 15 iii) From 5 to 10 iv) From 5 to 0 v) Never
5	How early and quickly business owners are able to sense the concerns of employees and society about your products and services? (Select one) i) Within 1 month ii) Within 3 months iii) Within 6 months iv) Within 1 year v) Very rarely
	STAKEHOLDER RELATIONSHIPS

6	How frequently owners sense and discuss stakeholders' (family members who have stake in business) relationships and their satisfaction with business? i) Every 3 months ii) Every 6 months iii) Every year iv) Every 2 years v) Never
7	Where will you rank your organization for its interest to protect health, safety and security of its employees (such as, health schemes, checkups, and safety measure trainings and good ergonomic arrangements for work); (Lowest rank is 1. Highest 5) i) 5 ii) 4 iii) 3 iv) 2 v) 1
8	How many times in last three months your business had met crisis and managed it effectively to continue business? i) From 15 to 20 ii) From 10 to 15 iii) From 5 to 10 iv) From 5 to 0 v) 0
9	Are there any modes of profit sharing with employees for their benefits? i) 4 and above ii) 3 iii) 2 iv) 1 v) 0

10	How often Competitor comparison & analysis is done, for the aspects of products, customer satisfaction and best practices? i) Every 3 months ii) Every 6 months iii) Every year iv) Every 2 years v) Never
	STRATEGY PROCESSES (FORMULATION & DEPLOYMENT)
11	What are the key factor(s) you consider while making action plans for growing your business? (Please tick) i) Roles and responsibilities ii) Resource allocation iii) Action plan execution duration iv) Crisis anticipation v) Disaster management
12	How frequently you collect data about markets and customers to use them in strategic planning processes? i) Every month ii) Every 3 months iii) Every 6 months iv) Every year v) Never
13	When last did your team include technological changes and Innovations in planning process? i) Last week ii) Last month iii) 2 months back iv) 6 months back v) Last year or beyond

14	How frequently you track the progress of the action plans? i) Everyday ii) Every week iii) Every month iv) Every 6 months v) At an interval of more than 6 months
15	What is the level of conflict between the organizational goals and stakeholder objectives needs? (High conflict – 5, Low Conflict – 1) i) 5 ii) 4 iii) 3 iv) 2 v) 1
	INFORMATION & KNOWLEDGE ASSETS MANAGEMENT
16	How frequently you collect data about your organization for planning business functions and activities? i) Every week ii) Every month iii) Every 6 months iv) Every year v) At an interval of more than an year
17	How quickly, continuously and accurately information can be accessed in your organization for decision-making? (5 – best at information acquisition dissemination; 1- worst at it) i) 5 ii) 4 iii) 3 iv) 2 v) 1

18	Does your organization have knowledge management forum/methods for employees to refer? i) Yes ii) No
19	How will you evaluate your organizations IT and knowledge network infrastructure for security and stability between 1 to 5? (Highest performance –5; lowest -1) i) 5 ii) 4 iii) 3 iv) 2 v) 1
20	Does your organization understand customer relationships and buying decisions through any systematic study? i) Yes ii) No
	FINANCIAL PERFORMANCE
21	How will you rate your organization for its capacity to identify the financial growth trends? [5 - Excellent understanding; 1 - Totally ignorant of sensing financial growth] i) 5 ii) 4 iii) 3 iv) 2 v) 1

22	Growth of Market share prices in the last 2 years i) More than 200% ii) Between 100% and 200% iii) Between 50% and 100% iv) Between 25% and 50% v) Less than 25%
23	Economic Value Analysis indicators show positive signs of growth in the last 2 years i) Yes ii) No
24	Profit growth in the last 2 years i) More than 200% ii) Between 100% and 200% iii) Between 50% and 100% iv) Between 25% and 50% v) Less than 25%
25	How many new business verticals had been started in the organization in the last 2 years? ------
	ORGANIZATIONAL SYSTEMIC EFFICIENCY
26	Are employees at a lower level located at different places empowered to decide independently? i) Yes ii) Sometimes – on a case to case basis iii) No

27	How often you change the workflow systems that are being followed? i) Every 3 months ii) Every 6 months iii) Every year iv) Every 2 years v) It hardly changes
28	How effectively your organization manages employee performance Management system? (Very well managed –5; poorly managed -1) i) 5 ii) 4 iii) 3 iv) 2 v) 1
29	Do all your employees have a career path in your organization? i) Mostly ii) Sometimes iii) Never
30	Rate the level of competency of your organization to identify productivity, cycle time, supplier, and partner performance for measuring organizational effectiveness (Highest performance 7; lowest 1) i) 5 ii) 4 iii) 3 iv) 2 v) 1
	BUSINESS PROCESS EFFICIENCY

31	How many value creating business processes you have in your business that impact financial performances directly? i) 500 and above ii) Between 100 and 500 iii) Between 50 and 100 iv) Between 5 and 50 v) Below 5
32	How many new technologies and tools you had used to design such value creating business processes in your organization? i) I have no clue ii) Between 10 and 20 iii) Between 20 and 50 iv) Between 50 and 100 v) We don't use technology for designing value creating processes
33	Have you reduced the costs of audits, inspections and process performance tests in your department? i) Yes ii) To an extent iii) No
34	Do you measure product and service improvements that happen through these value-creating business processes? i) Always ii) Sometimes iii) Never
35	Do you have well defined quality procedures and methodologies used in your organization to prevent defects / errors and rework process performances? i) Yes ii) Somewhat iii) No

	PRODUCT QUALITY & SERVICE PERFORMANCE
36	Do you have scales to identify and measure product and service quality your organization? i) Yes ii) No
37	How many different types of Total quality management programs are being implemented in your organization? i) Between 15 and 20 ii) Between 10 and 15 iii) Between 5 and 10 iv) Below 5 v) Nil
38	How often do you upgrade procedures for quality business processes in your organization? i) Every 3 months ii) Every 6 months iii) Every 1 year iv) Every 2 years v) It has hardly been done
39	Do you measure value adds at every stage of the value chain? i) Always ii) Sometimes iii) Never
40	Do you have scales to monitor continuously the quality of processes? i) Yes ii) No

Appendix 4

List of Selected Variables[1]

Variable No	Variable Name	Meaning of Variables
1	Ability to encourage organizational learning	Leaders interested in encouraging learning of organizations from their past performances and problems
2	Ability to have awareness on stakeholder needs	Leaders ability to sense and understand the needs of the stakeholders (suppliers, customers, employers and business owners) of the business
3	Ability to apply the learning	Leader's interest and capacity to incorporate the key learning from past experiences while planning the future
4	Ability to encourage innovation	Leaders interest in encouraging innovative business practices, processes and product innovations.
5	Ability to incorporate Societal sensitiveness system	Leader's interest to study the responses of society about their products and services periodically
6	Ability to focus on high level of Stakeholder satisfaction	Ability of organization to focus continuously on stakeholder satisfaction
7	Ability to provide schemes on employee welfare	Culture of organization to care for employee welfare, safety and security through proper employee care systems
8	Business continuity capacity	Ability of leaders of the organization to continue business in spite of Paining business environments, disasters And crisis.
9	Capacity to share Profit amongst all employees	Interest of business owners/organizations to share profits with employees through proper well designed schemes to trigger loyalty and commitment of employees for business profits
10	Capacity to operate on	Organization having consistent and

This lists the definitions of the 40 chosen variables for statistical analysis and model development in this research. A copy of this is handed over to the respondents for better clarity to fill in the questionnaire in addition to personal presence and explanations whenever required.

	Customer oriented competition analysis reports	well designed mechanism to collect and analyze data about customers, markets and competitors
11	Strategic planning efficiency	Skillful planning and execution of strategies at business, corporate and product levels by leaders
12	Capacity to utilize Customer and market valuation analysis	Interest of organizations to utilize information about markets and customers for strategic planning
13	Ability to incorporate Technology and Innovation in planning	Ability and flexibility of organizations to leverage technology and innovations for financial benefits completely
14	Ability of Tracking the progress	Interest of stakeholders and leaders to track action plans periodically and having proper systems to track them
15	Ability to know the trade off between organizational goal and stakeholder benefits	Organizations having any regular method to see the conflict in the goal of organization and stakeholder benefits
16	Ability of Incorporating information in strategic planning	Interest of leaders in considering information collected about organization, products, customers and market in strategic planning
17	Capacity to use information effectively	Seeking and accessing right kind of information and using them for the benefit of the organization at right time
18	Ability to build and manage knowledge assets	Capacity of leaders to build and manage knowledge assets such as experienced knowledge workers of the business and innovations, intellectual capacities of people
19	Having a Stable Information technology network	Presence of strong information technology infrastructure for managing information and information system
20	Capacity to manage Customer expectations	Ability of organizations to satisfy customer expectations by sensing them in advance and fulfilling their requirements in time through products and services
21	Financial Returns	Return on Equity, Return on Assets, Financial Growth
22	Market share growth	Growth rate of market share over a period of 1 year
23	Business Value	Growth in the Value of the entire business
24	Profit Growth	Growth of profit before tax
25	Rate of Business Expansion	Increase in business verticals and diversification
26	Ability to have Decentralized decision making systems	Employees empowered to make decisions
27	Capacity to have effective Work flow systems	Organizations having meaningful result oriented work flow systems
28	Capacity to utilize	Organizations using system management

	Performance management systems effectively	systematized performance management systems to improve productivity
29	Having effective Career planning systems	Organizations having plans and schemes for the career of employees
30	Having Improvement in cycle time of operating systems	Improvement in cycle time indicates the usage of information systems and efficient work flow systems
31	Having high Business process efficiency	Value based processes to deliver products/services
32	Ability to deploy New technology for business processes	High level of usage of technology in business process management
33	Having Strategic cost management of business processes	Cost benefits analysis done to measure the Effectiveness of business processes.
34	Having Variability reduction in business processes	Presence of variability from processes Indicate, Delay in cycle and response times. Variability reduction indicate efficiency in customer satisfaction levels
35	Having high Process performance	High process performance indicate effectiveness of processes designed
36	Having Standardized quality metrics for production / delivery processes	Interest of organization in delivering and maintaining high quality in services and products
37	Having highly Efficient quality management systems	Efficiencies and high level of satisfaction of quality management systems indicate cost reduction and satisfied customers
38	Ability to have Periodic up-gradation of quality management processes	Interest of organization in delivering high quality
39	Having Quality metrics along the value chain	Sustaining high quality along the value chain to Customers
40	Having systems to monitor quality continuously	Monitoring and upgrading quality systems as a quality culture of great companies

Appendix 5
Glossary

Key Terms related to the Analytical Framework - Exploratory Factor Analysis

Anti-image correlation matrix

This is the Matrix of the partial correlations among variables after factor analysis, representing the degree to which the factors explain each other in the results. The diagonal contains the *measures of sampling adequacy* for each variable, and the off-diagonal values are partial correlations among variables.

Bartlett test of sphericity

This is a Statistical test for the overall significance of all correlations within a correlation matrix.

Cluster analysis

This is a Multivariate technique with the objective of grouping respondents or cases with similar profiles on a defined set of characteristics and Similar to Q factor analysis. This can also be explained as, a collection of statistical techniques for creating homogeneous groups of cases or variables. Clusters are formed using distance functions. The elements in a cluster have relatively small distances from each other and relatively larger distances from elements outside of a cluster.

Common factor analysis

This is a Factor model in which the factors are based on a reduced correlation matrix. That is, communalities are inserted in the diagonal of the correlation matrix, and the extracted factors are based only on the common variance, with specific and error variance excluded. It can also be explained as a statistical technique which uses the correlations between observed variables to estimate common factors and the structural relationships linking factors to observed variables. The diagram below illustrates how two observed variables can correlate because of their relationships with a common factor. See *principal factor analysis*.
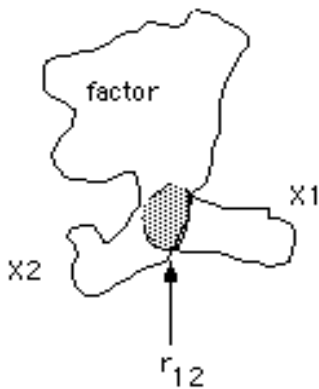
Common variance

Variance shared with other variables in the factor analysis. It can be explained as variance in a variable shared with common factors. Factor analysis assumes that a variable's variance is composed of three components: common, specific and error. The figure below illustrates the components in the variance of a variable. See *error variance*, *specific variance* and *unique variance*.
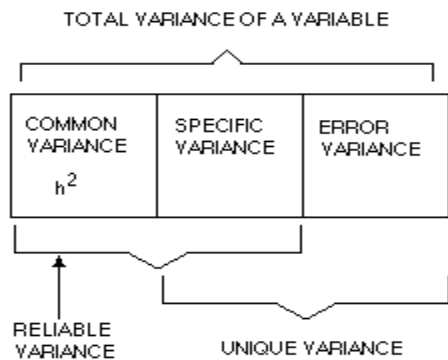
Communality

This is the total amount of variance an original variable shares with all other variables included in the analysis. To explain it in detail; it is the proportion of a variable's variance explained by a factor structure. A variable's commonality must be estimated prior to performing a factor analysis. Communality does not have to be estimated prior to performing a principal component analysis. Communality is denoted by h^2. See *Communality Estimates*

Communality estimates

This estimates of the proportion of common variance in a variable. *Prior communality estimates* are those which are estimated prior to the factor analysis. Common methods of prior communality estimation are to use (1) an independent reliability estimate, (2) the squared multiple correlation between each variable and the other variables, (3) the highest off-diagonal correlation for each variable, or (4) iterate by performing a sequence of factor analyses using the final communality estimates from one analysis as prior communality estimates for the next analysis. *Final communality estimates* are the sum of squared loadings for a variable in an orthogonal factor matrix.

Component analysis

This is a Factor model in which the factors are based on the total variance. With component analysis, unities (1s) are used in the diagonal of the correlation matrix; this procedure computationally implies that all the variance is common or shared.

Complex variable
It is a variable which loads on two or more factors.

Composite measure – This is also known as summated scales.

Conceptual definition - This is Specification of the theoretical basis for a concept that is represented by a factor.

Confirmatory factor analysis

It is a factor analysis performed for the purpose of confirming a hypothesized factor structure.

Content validity

Assessment of the degree of correspondence between the items selected to constitute a summated scale and its conceptual definition.

Correlation

This is the Pearson product moment correlation coefficient. The correlation between variables 1 and 2 is denoted by r12. The defining formula for r12 is

$$r_{12} = \sum_{i=1}^{N} (Z_{i1}Z_{i2}) / N$$

where Zi1 and Zi2 are the z-scores for case i on variables 1 and 2, and N is the sample size. In factor analysis we assume the correlation between two variables is due to their mutual relationships with common factors. See c*ommon factor analysis* and the *fundamental theorem of factor analysis*

Correlation matrix - It is a Table showing the Intercorrelation among all variables.

Cronbach's alpha

Measure of reliability that ranges from 0 to 1, with values of 60 to 70 deemed the lower limit of acceptability

Cross-loading

A variable has two more factor loading exceeding the threshold value deemed necessary for inclusion in the factor interpretation process.

Data matrix

This is the rectangular arrangement of the raw data on n cases over m variables. The most common data matrix is defined with rows for the cases and columns for the variables, and a factor analysis is performed to reduce the dimensionality of the columns (variables). This standard data matrix can be transposed for cluster analysis or Q factor analysis where the intent of the analysis is to reduce the dimensionality of the cases dimension.

Standard Data Matrix
Variables

```
      1   2  ...  m
     ┌──┬──┬──┬──┐
 1   │  │  │  │  │
 2   │  │  │  │  │
 3   │  │  │  │  │
Cases│  │  │  │  │
 .   │  │  │  │  │
 :   │  │  │  │  │
 n   └──┴──┴──┴──┘
```

Transposed Data Matrix
Cases

```
          1   2   ...  n
         ┌──┬──┬──┬──┐
      1  │  │  │  │  │
      2  │  │  │  │  │
      3  │  │  │  │  │
Variables│  │  │  │  │
      :  │  │  │  │  │
      m  └──┴──┴──┴──┘
```
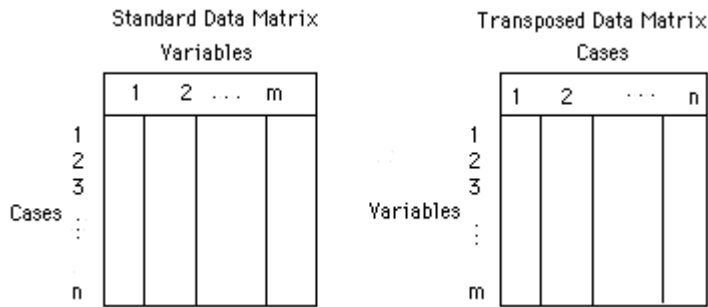
Data Reduction

This is reducing the number of cases or variables in a data matrix. For example, a factor analysis can be used to replace a large collection of variables with a smaller number of factors. A Q-factor analysis is used to replace a larger sample of cases with a fewer number of similar groups.

Diagonal Factoring

This is an orthogonal decomposition of the variance of a set of variables which uses residuals from regression models. Suppose you were analyzing three variables X_1, X_2 and X_3. The first diagonal factor could be X_1. The second diagonal factor could be X_2 residualized for X_1. Finally, the third factor would be X_3 residualized for X_1 and X_2.

Distance

This is a measure of the disparity between two observations on a set of variables. The most common measure is the squared Euclidian distance which is the sum of squared differences across a set of variables. Letting m = the number of variables, and Xij be the value of the j-th variable for the i-th case, the squared Euclidian distance between cases k and l is

$$D_{kl}^2 = \sum_{j=1}^{m} (Xkj - Xlj)^2$$

Distance functions are used in cluster analysis to form clusters of variables or cases which are most similar or have small distances.

Dummy variable

Binary metric variable used to represent a single category of a no metric variable.

A-5   v

Eigenvalue

Column sum of squared loading for a factor; also referred to as the latent root. It represents the amount of variance accounted for by a factor. This can be explained further as, the variance in a set of variables explained by a factor or component, and denoted by *lambda*. An eigenvalue is the sum of squared values in the column of a factor matrix, or

$$\lambda_k = \sum_{i=1}^{m} a_{ik}^2$$

where a_{ik} is the factor loading for variable i on factor k, and m is the number of variables. In matrix algebra the principal eigenvalues of a correlation matrix **R** are the roots of the characteristic equation $|R\text{-}lambda| = 0$; where **R** is a square matrix, *lambda* is a diagonal matrix, and $|R\text{-}lambda|$ denotes the determinant of *R- lambda.*

EQUIMAX

One of the orthogonal factor rotation methods that is a "compromise" between the VARIMAX and QUARTIMAX approaches, but is not widely used. It is an analytic factor rotation criterion which simplifies the rows *and* columns of a factor matrix. See *quartimax*, *rotation*, *simple structure* and *varimax.*

Exploratory Factor Analysis

It is a factor analysis used to explore the underlying structure of a collection of observed variables, when there are no a priori hypotheses about the factor structure. See *confirmatory factor analysis*.

Error variance – It is Variance of a variable due to errors in data collection or measurement; unreliable and inexplicable variation in a variable. Error variance is assumed to be independent of common variance, and a component of the unique variance of a variable. See *common variance, unique variance* and *specific variance*

Face validity - This is same as content validity

Factor

It is a Linear combination (variate) of the original variables. Factors also represent the underlying dimensions (constructs) that summarize or account for the original set of observed variables.

Factor Analysis

It is a statistical technique used to (1) estimate factors or latent variables, or (2) reduce the dimensionality of a large number of variables to a fewer number of factors.

Factor indeterminacy

This represents Characteristics of common factor analysis such that several different factor scores can be calculated for a respondent, each fitting the estimated factor model. It means the factor scores are not unique for each individual.

Factor loadings

It is a term used to refer to factor pattern coefficients or structure coefficients. See *factor pattern coefficients* and *factor structure coefficients. Factor Loadings* are the Correlation between the original variables and the factors, and the key to understanding the nature of a particular factor. Squared factor loading indicate what percentage of the variance in an original variable is explained by a factor.

Factor Matrix

It is a Table displaying the factor loadings of all-variable on each factor. It can be explained as a matrix of pattern or structure coefficients in which the factors are presented as columns and the variables are presented as rows.

Factor Matrix

Factor Pattern Coefficients

This is a set of regression coefficients which multiply with factors to produce measured variables according to the common factor model. The observation measured on case i for variable j, Xij, is assumed to be related to k underlying factors as follows:

Xij = pj1Fi1 + pj2Fi2 + + pjkFik + uij, where $p_{jk}$is the *pattern coefficient* for variable j on factor Fk, Fik is the value for case i on factor k, and uij is the unique component of Xj for case i. See *factor structure coefficient* and *factor loading*.

Factor pattern matrix
One of two factor matrices found in an oblique rotation that is most comparable to the factor matrix in an orthogonal rotation.

Factor rotation
It is a Process of manipulation or adjusting the factor axes to achieve a simpler and pragmatically more meaningful factor solution.

Factor score
Composite measure created for each observation on each factor extracted in the factor analysis. The factor weights are used in conjunction with the original variable values to calculate each observation's score. The factor score then can be used to represent the factor (s) in subsequent analyses. Factor scores re standardized to have a mean of 0 and standard deviation of 1. This can also be explained as, linear combinations of variables which are used to estimate the cases' scores on the factors or components. Least squares estimates of factor scores are the most commonly used.

Factor structure matrix
A factor matrix found in an oblique rotation that represents the simple correlations between variables and factors, incorporating the unique variance and the correlations between factors. Most researchers prefer to use the factor pattern matrix when interpreting an oblique solution. It is a Pearson correlation between a variable and a factor. See *factor pattern coefficient* and *factor loading*.

Fundamental Theorem of Factor Analysis
It is a theorem which asserts that the correlation between two variables is the sum of the products of their factor loadings over k orthogonal common factors. Letting Pim represent the pattern coefficient for variable i on factor m, and Pjm be the pattern coefficient for variable j on factor m, then

$$r_{ij} = \sum_{m=1}^{k} p_{im}p_{jm}$$

More generally, the correlation matrix (with communalities in the main diagonal) is equal to the pattern matrix post multiplied by its transpose.

(R-U)= F F' or R = F F'+ U;

where **R** is correlation matrix, **U** is a diagonal matrix of uniquenesses, **F** is the pattern matrix and **F'** is the transpose of **F**.

General factor – It is a factor on which all the variables load.

Grammian matrix

It is a symmetric square matrix whose eigenvalues are all greater than or equal to zero.

Image Analysis

It is **a** common factor analysis of the predictable variance of a set of variables. Each variable, Xi (i=1,m), is regressed on the remaining (m-1) variables to obtain the predicted Xi values. Then the covariance matrix of the predicted Xi's is factored to produce an image analysis. *See image of a variable.*

Image of a variable

It is the component of a variable which is predicted from other variables. Antonym: anti-image of a variable.

Indeterminacy

It is impossible to estimate population factor structures exactly because an infinite number of factor structures can produce the same correlation matrix. There are more unknowns than equations in the common factor model. Therefore, we cannot uniquely determine factor structures. See *fundamental theorem of factor analysis*.

Indicator

Single variable used in conjunction with one or more other variables to form a composite measure.

Latent variable

This is a theoretical variable hypothesized to influence a number of observed variables. Common factor analysis assumes latent variables are linearly related to observed variables. Factors are sometimes construed to be estimates of latent variables. See *factor pattern coefficients*.

Latent root - This is same as eigenvalue

Loading

It is the correlation between a variable and a factor. See factor pattern coefficients, factor structure coefficients.

Main Diagonal - the elements in a square matrix ranging from the upper left to the lower right corners of the matrix.

$$
\mathbf{A}_{mm} = \begin{bmatrix} a_{11} & \cdots & a_{1m} \\ \cdots & & \cdots \\ \cdots & & \cdots \\ \cdots & & \cdots \\ a_{m1} & \cdots & a_{mm} \end{bmatrix} \longleftarrow \text{main diagonal}
$$
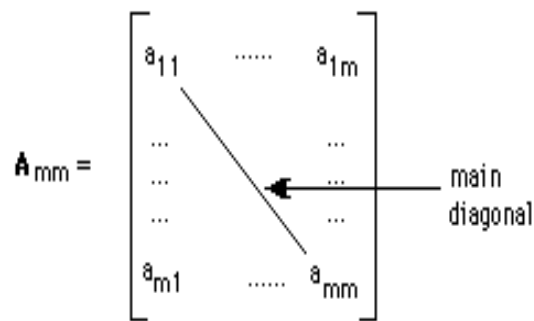
Communality estimates are inserted in the main diagonal of a correlation matrix when performing a factor analysis. When performing a principal component analysis the main diagonal elements of the correlation matrix will be 1s.

Maximum likelihood estimation – It is a method of parameter estimation in which a parameter is estimated to be that value for which the data are most likely.

Measure of Sampling Adequacy (MSA)

Measure calculated both for the entire correlation matrix and each individual variable evaluating the appropriateness of applying factor analysis. Values above 50 for either matrix or an individual variable indicate appropriateness.

Measure error

Inaccuracies in measuring the "true" variable values due to the fallibility of measurement instrument (i.e., inappropriate response scales), data entry errors, or respondent errors.

Oblique Factors - Correlated factors. See *orthogonal factors*.

Oblique factor rotation

Factor rotation computed so that the extracted factors are correlated. Rather than arbitrarily constraining the factor rotation to an orthogonal solution, the oblique rotation identifies the extent to which each of the factors is correlated.

Orthogonal - Mathematical independence (no correlation) of factor axes to each other (i.e., at right angles, or 90 degrees).

Orthogonal Decomposition of Variables

It is transforming a set of correlated variables into a set of uncorrelated variables. See *principal component analysis*, and *principal factor analysis*.

Orthogonal Factors - Uncorrelated factors. See *oblique factors*.

Orthogonal factor rotation

This is explained as Factor rotation in which the factors are extracted so that their axes are maintained at 90 degrees. Each factor is independent of, or orthogonal to, all other factors. The correlation between the factors is determined to be 0.

Parallel Analysis

This is performing the same analysis on random, uncorrelated data which has been performed on observed data. The random data are generated under a null condition. Columns of observed data matrices can also be randomly permuted to simulate null structures. Parallel analysis is used for statistical inference in situations where sampling distributions are unknown or intractable

Principal Components Analysis

i)   A method of factoring a correlation matrix directly, without estimating communalities. Linear combinations of variables are estimated which explain the maximum amount of variance in the variables. The first component accounts for the most variance in the variables. Then the second component accounts for the most variance in the variables residualized for the first component, and so on.

ii)   Transforms a collection of measured variables into a set of orthogonal maximum variance linear combinations

Principal Factor Analysis

It is a method of factor analysis using a priori communality estimates. Successive factors are extracted which explain the most variation in a set of variables. The first factor accounts for the most variance. Then the second factor accounts for the most variance in the variables residualized for the first factor, and so on. The factors are uncorrelated.

Parsimony principle

When two or more theories explain the data equally well, select the simplest theory. Factor analysis application: If a two-factor and a three-factor model explain about the same amount of variance, interpret the two-factor model.

Procrustean rotation

It is rotating factors to a target structure. The target structure is usually specified prior to the analysis.

Q factor analysis

Forms groups of respondents or cases based on their similarity on a set of characteristics. It is also factoring the inter case correlation matrix

QUARTIMAX - A type of orthogonal factor rotation method focusing on simplifying the columns of a factor matrix; Generally considered less effective than the VARIMAX rotation.

Quartimax Rotation – It is an orthogonal rotational criterion which maximizes the variance of the rows of a factor matrix.

R factor analysis

This analyzes relationships among variables to identify groups of variables forming latent dimensions (factors); factoring the inter - variable correlation matrix; the most common form of factor analysis.

Reliability

Extent to which a variable or set of variables is consistent in what it is intended to measure. If multiple measurements are taken, reliable measures will all be consistent in their values. It differs from validity in that it does not relate to what should be measured, but instead to how it is measured.

Residual Correlation Matrix

It is a correlation matrix of the unique components of the variables. Letting **F** be an orthogonal factor matrix and **R** be the correlation matrix, then the residual correlation matrix is

Rr = R -F F' ; See unique variance , the fundamental theorem of factor analysis

Reverse scoring

This is a process of reversing the scores of a variable, while retaining the distributional characteristics, to change the relationships (correlations) between two variables; Used in summated scale construction to avoid a canceling out between variables with positive and negative factor loading on the same factor.

Rotation of Factors

It is a transformation of the principal factors or components in order to approximate simple structure. A graphic illustration of rotation is presented below. F1 and F2 are the principal factors, and R1 and R2 are the rotated factors. The rotation was clockwise over an angle of q. The variable vectors are represented by the black dots. Notice how the variables divide out between the rotated factors, but tend to bunch up on the principal factors.

Θ = angle of rotation

Graphic Illustration of Factor Rotation
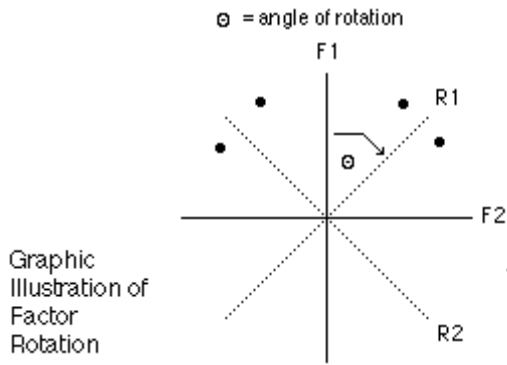
See equamax, oblique factors, orthogonal factors, quartimax, simple structure, varimax.

Scree test

This is a graphic method for determining the number of factors. The eigenvalues are plotted in the sequence of the principal factors. The number of factors is chosen where the plot levels off to a linear decreasing pattern. The figure below suggests a two-factor solution, since the eigenvalues begin a linear decline commencing with the third factor.
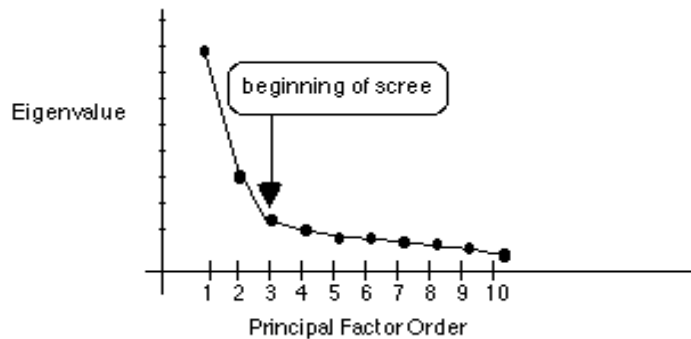
Graphic Illustration of a Scree Test Yielding Two Factors

Simple Structure

This is Louis Thurstone's interpretability criteria for factor structures. A factor matrix for k factors exhibits simple structure if, (i) Each variable has at least one zero loading (ii) Each factor in a factor matrix with k columns should have k zero loadings (iii) Each pair of columns in a factor matrix should have several variables loading on one factor but not the other (iv) Each pair of columns should have a large proportion of variables with zero loadings in both columns (v) Each pair of columns should only have a small proportion of variables with non zero loadings in both columns.

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Specific Factor – It is a factor on which only one variable loads.

Specific variance

It is the variance of each variable unique to that variable and not explained or associated with other variables in the factor analysis. It is also defined as the component of unique variance which is reliable but not explained by common factors. See *common variance.*

Square Matrix

It is a matrix with the same number of rows as columns.

Summated scales

This is a Method of combining several variables that measure the same concept into a single variable in an attempt to increase the reliability of the measurement. In most instances, the separate variables are summed and then their total or average score is used in the analysis.

Surrogate variable

This is a single variable that is selected with the highest factor loading to represent a factor in the data reduction stage instead of using a summated scale or factor score.

Trace

This represents the total amount of variance on which the factor solution is based. The trace is equal to the number of variables, based on the assumption that the variance in each variable is equal to 1. In short it is the sum of the main diagonal elements of a square matrix. *See main diagonal.*

Uniqueness

This is the proportion of a variable's variance that is not shared with a factor structure. The uniqueness of a variable is $(1-h^2)$.

Unique Variance

This is same as specific variance. This is that variance of a variable which is not explained by common factors. Unique variance is composed of specific and error variance. See common, specific and error variance. The uniqueness of a variable is $(1-h^2)$. See *common variance*.

Validity

Extent to which a measure or set of measures correctly represents the concept of study-the degree to which it is free from any systematic or nonrandom error. Validity is concerned with how well the concept is defined by the measure(s), whereas reliability relates to the consistency of the measure(s).

Variate

Linear combination of variables formed by deriving empirical weights applied to a set of variables specified by the researcher. Linear Combination is given as; A variable L is said to be a linear combination of a set of variables (X1, X2, , Xk) if

L = a1X1 + a2X2 + + akXk,

where the ai (i=1,k) are coefficients. In the common factor model, variables are linear combinations of common factors and unique factors. Factor scores are estimated using linear combinations of variables.

VARIMAX

This is the most poplar orthogonal factor rotation methods focusing on simplifying the columns in a factor matrix; Generally considered superior to other orthogonal factor rotation methods in achieving a simplified factor structure.

Varimax Rotation

It is an orthogonal rotation criterion which maximizes the variance of the squared elements in the columns of a factor matrix. Varimax is the most common rotational criterion.

Key Terms related to the Analytical Framework - Multiple Regression Analysis

Adjusted coefficient of determination (adjusted R)

Modified measure of the coefficient of determination that takes into account the number of independent variables included in the regression equation and the sample size. Although the addition of independent variables will always cause the coefficient of determination to rise, the adjusted coefficient of determination may fall if the added independent variables have little explanatory power or if the degrees of freedom become too small. This statistic is quite useful for comparison between equations with different numbers of independent variables, differing sample sizes, or both.

All-possible-subsets regression

Method of selecting the variables for inclusion in the regression model that considers all possible combinations of the independent variables. For example, if the researcher specifies four potential independent variables, this technique would estimate all possible regression models with one, two, three, and four variables. The technique would then identify the model(s) with the best predictive accuracy.

Backward elimination

Method of selecting variables for inclusion in the regression model that starts by including all independent variables in the model and then eliminating those variables not making a significant contribution to prediction.

Beta coefficient

This is a Standardized regression coefficient (see standardization) that allows for a direct comparison between coefficients as to their relative explanatory power of the dependent variable. Whereas

regression coefficients are expressed in terms of the units of the associated variables, thereby making comparisons inappropriate, beta coefficients use standardized data and can be directly compared.

Coefficient of determination (R)

This is a Measure of the proportion of the variance of the dependent variable about its mean that is explained by the independent, or predictor, variables. The coefficient can vary between 0 and 1. if the regression model is properly applied and estimated, the researcher can assume that the higher value of R, the greater the explanatory power of the regression equation, and therefore the better the prediction of the dependent variable.

Collinearity

It is an Expression of the relationship between two (collinearity) or more (multicollinearity) independent variables. Two independent variables are said to exhibit complete collineaity if their correlation coefficient is 1, and complete lack of collinearity if their correlation coefficient is 0. Multicollinearity occurs when any single independent variable is highly correlated with a set of other independent variables. An extreme case of collinearity / multicollinearity is singularity, in which an independent variable is perfectly predicted (i.e. correlation of 1.0) by another independent variable (or more than one).

Correlation coefficient (r)

This is a Coefficient that indicates the strength of the association between any two metric variables. The sign (+ or -) indicates the direction of the relationship. The value can range from +1 to –1, with +1 indicting a perfect positive relationship, 0 indicating no relationship, and –1 indicating a perfect negative or reverse relationship (as one variable grows larger, the other variable grows smaller).

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Criterion variable (Y) – This is same as dependent variable.

Degree of freedom (df)

Value calculated from the total number of observations minus the number of estimated parameters. These parameter estimates are restrictions on the data because, once made, they define the population from which the data re assumed to have been drawn. For example, in estimating a regression model with single independent variables, we estimate two parameters, the intercept (b0). And a regression

coefficient for the independent variable (b1). In estimating the random error, defined as the sum of the prediction errors (actual minus predicted dependent values) for all cases, we would find (n-2) degrees of freedom. degrees of freedom provide a measure of how restricted the data are to reach a certain level of prediction. If the number of degree freedom is small, the resulting prediction may be less generalizable because all but a few observations were incorporated in the prediction. Conversely, a large degrees-of-freedom value indicates the prediction is fairly robust with regard to being representative of the overall sample of respondents.

Dependent variable (Y)

Variable being predicated or explained by the set of independent variables.

Dummy variable

Independent variable used to account for the effect that different levels of a nonmetric variable have in predicting the dependent variable. To account for L levels of a nonmetric independent variable, L – 1 dummy variables are needed. For example, gender is measured as male or female and could be represented by two dummy variables, X1 and x2. When the respondent is male, X1 = 1 and X2 = 0. Likewise, when the respondent is female, X1 = 0 and X2 = 1. However, when X1 = 1, we know that X2 must equal 0. Thus, we need only one variable, either X1 or X2, to represent gender. We need not include both variable because one is perfectly predicted by the other (a singularity) and the regression coefficients cannot be estimated. If a variable has three levels, only two dummy variables are needed. Thus, the number of dummy variables is one less than the number of levels of the nonmetric variable. The two most common methods of determining the values of the dummy values are indicator coding and effects coding.

Effect coding

This is a Method for specifying the reference category for a set of dummy variable in which the reference category receives a value of – 1 across the set of dummy variables. In our example of dummy variable coding for gender, we coded the dummy variable as either 1 or 0. but with effects coding, the value of –1 is used instead of 0. With this type of coding, the coefficients for the dummy variables become group deviations on the dependent variable from the mean of the dependent variable across all groups. Effects coding contrasts with indicator coding, in which the reference category is given the

value of zero across all dummy variables and the coefficients represent group deviations on the dependent variable from the reference group.

Forward addition

This is a Method of selecting variables for inclusion in the regression model by starting with no variables in the model and then adding one variable at a time based on its contribution to prediction.

Heteroscedasticity

Description of data for which the variance of the error terms (e) appears constant over the range of values of an independent variable. The assumption of equal variance of he population error & (where & is estimated from the sample value e) is critical to the proper application of linear regression. When the error terms have increasing or modulating variance, the data are said to be heteroscedastic otherwise homoscedastic.

Independent variable

Variable(s) selected as predictors and potential explanatory variables of the dependent variable.

Indicator coding

This is a Method for specifying the reference category for a set of dummy variable where the reference category receives a value of zero across the set of dummy variable. The regression coefficients represent the group differences in the dependent, variable from the reference category. Indictor coding differs from effects coding, in which the reference category is given the value of –1 across all dummy variables and the regression coefficients represent group deviation on the dependent variable from the overall mean of the dependent variables.

Influential observation

An observation that has a disproportionate influence on one or more aspects of the regression estimates. The influence may be based on extreme values of the independent or dependent variables, or both. Influential observations can either be "good", by reinforcing the pattern of the remaining data, or "bad", when a single or small set of cases unduly affects the regression estimates. It is not necessary for the observation to be an outlier, although many times outliers can be classified as influential observations as well.

Intercept (b0)

Value on the Y axis (dependent variable axis) where the line defined by the regression equation Y= b0 + b1X1 crosses the axis. It is described by the constant term b0 in the regression equation. In addition to its role in prediction, the intercept may have a managerial interpretation. If the complete absence of the independent variable has meaning, then the intercept represents that amount. For example, when estimating sales from past advertising expenditures, the intercept represents the level of sales expected if advertising is eliminated. But in many instances the constant has only predictive value because in no situation are all independent variables absent. An example is predicting product preference based on consumer attitudes. All individuals have some level of attitude, so the intercept has no managerial use, but it still aids in prediction.

Least squares

This is an Estimation procedure used in simple and multiple regression whereby the regression coefficients are estimated so as to minimize the total sum of the squared residuals.

Leverage points

Type of influential observation defined by one aspect of influence termed leverage. These observations are substantially different on one or more independent variables, so that they affect the estimation of one or more regression coefficients.

Linearity

Term used to express the concept that the model possesses the properties of additivity and homogeneity. In a simple sense, linear models predict values that fall in straight line by having a constant unit change (slope) of the dependent variable for constant unit change of the independent variable. In the population model Y = b0 + b1X1 + &, the effect of changing x1 by a value of 1.0 is to add b1 (a constant) units of Y.

Measurement error

It is the Degree to which the data values do not truly measure the characteristic being represented by the variable. For example, when asking about total family income, many sources of measurement error

(e.g., reluctance to answer full amount, error in estimating total income) make the data values imprecise.

Moderator effect

Effect in which a third independent variable (the moderator variable) causes the relationship between a dependent / independent variable pair to change, depending on the value of the moderator variable. It is also known as an interactive effect and similar to the interaction effect seen in analysis of variance methods.

Multicollinearity – Collinearity between many Independent Variables. This is also an extent to which a variable can be explained by the other variables in the factor analysis.

Multiple Regressions

Regression model with two or more independent variables.

Normal probability plot

Graphical comparison of the shape of the sample distribution to the normal distribution, in the graph, the normal distribution is represented by a straight line angled at 45 degrees. The actual distribution is plotted against this line, so any differences are shown as deviations from the straight line, making identification of differences quite simple.

Null plot

Plot of residuals versus the predicted values that exhibit a random pattern. A null plot is indicative of no identifiable violations of the assumptions underlying regression analysis.

Outlier

It is an observation that has a substantial difference between the actual value for the dependent variable and the predicted value. Cases that are substantially different with regard to either the dependent or independent variables are often termed outliers as well. In all instances, the objective is to identify observations that are inappropriate representations of the population from which the sample is drawn, so that they may be discounted or even eliminated from the analysis as unrepresentative.

Parameter

It is a Quantity (measure) characteristic of the population. For example, m and o are the symbols used for population parameters mean (μ) and variance ($\sigma2$). they are typically estimated from sample data in which the arithmetic average of the sample is used as a measure of the population average and the variance of the sample is used to estimate the variance of the population .

Part correlation

This is a Value that measures the strength of relationship between a dependent and a single independent variable when the predictive effects of the other independent variables in the regression model are removed. The objective is to portray the unique predictive effect due to a single independent variable among a set of independent variables. It differs from the partial correlation coefficient, which is concerned with incremental predictive effect.

Partial correlation coefficient

This is a Value that measures the strength of the relationship between the criterion or dependent variable and single independent variable when the effects of the other independent variables in the model are held constant. For example, $rY,X2,X1$ measure the variation in Y associated with X2 when the effect of X1 on both X2 and Y is held constant. This value is used in sequential variable selection methods of regression model estimation (e.g., stepwise, forward addition, or backward deletion) to identify the identify variable with the greatest incremental predictive power beyond the independent variables already in the regression model.

Partial F (or t) values

The partial F-test is simply a statistical test for the additional contribution to prediction accuracy of a variable above that of the variables already in the equation. When a variable (Xa) is added to a regression equation after other variables are already in the equation, its contribution may be small even though it has a high correlation with the dependent variable. The reason is that Xa is highly correlated with the variables already in the equation. The partial F value is calculated for all variables by simply pretending that each, in turn, is the last to enter the equation. It gives the additional contribution of each variable above all others in the equation. A low or insignificant partial F value for a variable not in the equation indicates its low or insignificant contribution to the model as already specified. A t value

may be calculated instead of F values in all instances, with the t value being approximately the square root of the F value.

Partial regression plot

It is a Graphical representation of the relationship between the dependent variable and a single independent variable. The scatter plot lot of points depicts the partial correlation between the two variables, with the effects of other independent variables held constant (see partial correlation coefficient). This portrayal is particularly helpful in assessing the form of the relationship (linear versus nonlinear) and the identification of influential observations.

Polynomial

This represents a Transformation of an independent variable to represent a curvilinear relationship with the dependent variable. By including a squared term (X2), a single inflection point is estimated. A cubic term estimates a second inflection point. Additional term of a higher power can also be estimated.

Power

It is defined as the Probability that a significant relationship will be found if it actually exists; Complements the more widely used significance level alpha (α).

Prediction error

It is the difference between the actual and predicted values of the dependent variable for each observation in the sample (see residual).

Predictor variable (Xn) – This same as independent variable.

PRESS statistic

Validation measure obtained by eliminating each observation one at a time and predicting this dependent this dependent value with the regression model estimated from the remaining observations.

Reference category

It is the omitted level of nonmetric variable when a dummy variable is formed from the nonmetric variable.

Regression coefficient (bn)

Numerical value of the parameter estimate directly associated with an independent variable; for example, in the model Y = b0 + b1 X1, the value b1 is the regression coefficient for the variable X1. The regression coefficient represents the amount of change in the dependent variable for a one-unit change in the independent variable. In the multiple predictor model (e.g., Y = b0 + b1X1 + b2X2), the regression coefficients are partial coefficient because each takes into account not only the relationship between Y and X1 and between Y and X2, but also between X1 and X2. The coefficient is not limited in range, as it is based on both the degree of association and the scale units of the independent variable. For instance, two variables with the same association to Y would have different coefficient if one independent variable was measured on a 7-point scale and another was based on a 100-point scale.

Regression variate

Linear combination of weighted independent variables used collectively to predict the dependent variable.

Residual (e or ε)

It is an error in predicting our sample data. Seldom will our predictions be perfect. We assume that random error will occur, but we assume that this error is an estimate of the true random error in the population (ε), not just the error in prediction for our sample (e). We assume that the error in the population we are estimating is distributed with a mean of 0 and a constant (homoscedastic) variance.

Sampling Error

The expected variation in any estimated parameter (intercept or regression coefficient) that is due to the use of a sample rather than the population. Sampling error is reduced as the sample size is increased and is used to statistically test whether the estimated parameter differ from zero.

Significance level (alpha)

Commonly referred to as the level of statistical significance, the significance level represents the probability the researcher is willing to accept that the estimated coefficient is classified as different from zero when it actually is not. This is also known as Type I error. The most widely used level of

significance is .50, although researchers use levels ranging from .01 (more demanding) to .10 (less conservative and easier to find significance).

Simple regression

It is a Regression model with a single independent variable, also known as Bivariate regression.

Singularity

The extreme case of collinearity or multicollinearity in which an independent variable is perfectly predicted (a correlation of +1.0) by one or more independent variable. Regression models cannot be estimated when a singularity exists. The researcher must omit one or more of the independent variables involved to remove the singularity.

Specification error

It is known as the error in predicting the dependent variable caused by excluding one or more relevant independent variables. This omission can bias the estimated coefficients of the included variables as well as decrease the overall predictive power of the regression model.

Standard error

It is the Exported distribution of an estimated regression coefficient. The standard error is similar to the standard deviation of any set of data values, but instead denotes the expected range of the coefficient across multiple samples of the data. It is useful in statistical tests of significance that test to see whether the coefficient is significantly different from zero. (i.e., whether the expected range of coefficient contains the value of zero at a give level of confidence). The t value of a regression coefficient is the coefficient divided by its standard error.

Standard error of the estimate (SEe)

It is the Measure of the variation in the predicted values that can be used to develop confidence intervals around any predicted value. It is similar to the standard deviation of a variable around its mean, but instead is the expected distribution of predicted values that would occur if multiple samples of the data were taken.

Standardization

It is a process whereby the original variable is transformed into a new variable with a mean of 0 and a standard deviation of 1. The typical procedure is to first subtract the variable mean from each observation's value and then divide by the standard deviation. When all the variables in a regression variate are standardized, the b0 term (the intercept) assumes a value of 0 and the regression coefficients are known as beta coefficients, which enable the researcher to compare directly the relative effect of each independent variable on the dependent variable.

Statistical relationship

Relationship based on the correlation of one or more independent variables with the dependent variable. Measures of association, typically correlations, represent the degree of relationship because there is more than one value of the dependent variable for each value of the independent variable.

Stepwise estimation

Method of selecting variables for inclusion in the regression model that starts by selecting the best predictor of the dependent variable. Additional independent variables are selected in terms of the incremental explanatory power they can add to the regression model. Independent variables are added as long as their partial correlation coefficients are statistically significant. Independent variables may also be dropped if their predictive power drops to a non-significant level when another independent variable is added to the model.

Studentized residual

The most commonly used form of standardized residual. It differs from other method in how it calculates the standard deviation used in standardization. To minimize the effect of any observation I is computed from regression estimates omitting the $i'th$ observation in the calculation of the regression estimates.

Sum of squared errors (SSe)

This is the Sum of squared prediction errors (residuals) across all observations. It is used to denote the variance in the dependent variable not yet accounted for by the regression model. If no independent variables are used for prediction, it becomes the squared errors using the mean as the predicted value and thus equals the total sum of squares.

Sum of squares regression (SSr)

It is the sum of squared differences between the mean and predicted values of the dependent variable of all observations. It represents the amount of improvement in explanation of the dependent variable attributable to the independent variable(s).

Suppression effect

The instance in which the expected relationship between independent and dependent variables are hidden or suppressed when viewed in a bivariate relationship. When additional independent variables are entered, the multicollinearity removes the "true" relationship.

Tolerance

This is commonly used measure of collinearity and multicollinearity. The tolerance of variable ì (TOL ì) is 1 – R* ì is the coefficient of determination for the prediction of variable ì by the other independent variables in the regression variate. As the tolerance value grows smaller, the variable is more highly predicted by the other independent variables (collinearity).

Total sum of squares (SSt)

It is known as the total amount of variation that exists to be explained by the independent variables. This baseline value is calculated by summing the squared differences between the mean and actual values for the dependent variable across all observations.

Transformation

A variable may have an undesirable characteristic, such as non-normality, that detracts from the ability of the correlation coefficient to represent the relationship between it and another variable. A transformation, such as taking the logarithm or square root of the variable, creates a new variable and eliminates the undesirable characteristic, allowing for a better measure of the relationship. Transformation may be applied to either the dependent or independent variables, or both. The need and specific type of transformation may be based on theoretical reason (such as transforming a known nonlinear relationship) or empirical reasons (identified through graphical or statistical mans).

Variance inflation factor (VIF)

This is an indicator of the effect that the other independent variables have on the standard error of a regression coefficient. The variance inflation factor is directly related to the tolerance value.

($VIF_i = 1/TOL_i$) Large VIF values also indicate a high degree of collinearity or multicollinearity among the independent variables.