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Master's Dissertation 2014

Development of Safety Culture Assessment System Applicable for Chemical Industries in World-Wide Application

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September 2014

Graduate School of System Design and Management,
Keio University
Major in System Design and Management
Research Intensive Course

SUMMARY OF MASTER'S DISSERTATION

Student Identification Number	81234511	Name	CHIN SHUNA

Title

Develop Safety Culture Assessment System Applicable for Chemical Industries in World-Wide Application

Abstract

Safety cultures can be explained details in safety culture eight axes which are motivation, governance, communication, commitment, resource allocation, work practice, learning training and awareness. Safety culture is important to be applied in various industries and workplaces as there are many industry accidents happened at past time. Hence, A proper safety culture measurement had developed since few years ago. Further data are necessary to collect and making research. In this research report, it is discussed about finding integrated safety culture assessment system (SCAS) questionnaires between Japan and France in chemical industries. Safety culture assessment system (SCAS) is using questionnaires method. Japan SCAS will be conducted by 110 SCAS questionnaires method. France SCAS questionnaires will be executed by The Institute for an Industrial Safety Culture (ICSI). 800 sample data from Japan Chemical Company A are collected. And using the regression analysis and multivariate analysis to apply on questionnaires data which collect from Japan Chemical Company A. From analysis data result, it can find out the common and integrated questionnaires between both countries. After get the integrated questionnaires from both countries, then proceed on determine the validation of integrated SCAS questionnaires by principle component analysis by using 20 divisions of Japan Chemical Company A. As conclude, generate integrated SCAS questionnaires are the target of this study and as benchmark questionnaires that can be used for worldwide chemical industries application in future.

Safety Culture Assessment Method, Safety Culture, Integrated SCAS questionnaire, Chemical Industry, Regression Analysis and Multivariate Analysis.

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1. INTRUDUCTION

1.1 Background of Study

Safety Culture this term is first appear in International Atomic Energy Agency's initial report because by the Chernobyl disaster (IAEA, 1986). Ever Since these inquiries into major accidents such as the King's Cross Fire (Fennell, 1988), Herald of Free Enterprise (Justin Sheen, 1987) and Piper Alpha (Cullen, 1990) have found faults in organization structures and safety management systems, and bring the importance of safety culture into the spotlight.

There were a large number of industry accidents especially at chemical, nuclear and oil & gas industry. An explosion oil storage tank happened at Idetmitsu Tiba refinery. There is another big accident at the Bridgestone factory and fatal explosion at Nippon Steel Corporation from 2003 to 2005. These accidents cause to labor fatal, facilities failures, huge money losing, and it may effects to environment pollution by chemical gas released after explosion or water pollution when petroleum leaked to ocean and so on. Industry accident happened due to lack of safety culture information in company, poor management, insufficient communication between upper management and general workforce, low safety culture conscious at organization climates, lack safety training to work people and so forth. All of above mentioned are directly link to safety culture.

In general, safety culture defined as behavior aspects and condition aspects of company. Safety culture also refers to work environment's characteristic and its specialties, for example, regulations, norms, and common understanding that effect to plant personnel's perceptions of the importance to place in organization places. It is included the degree to which a crucial, questioning attitude exists that is directed toward organization or plant improvement. Safety Culture also similar with the definition safety climates which are

referring to psychological of employee's characteristic and thinking, corresponding to the attitude, moral mind, safety mind, and ideas of employees with regards to safety within an organization. This specialty has been considered in developing of safety culture or creates safety climates in various industries such as oil and gas, chemical, nuclear power, petroleum and so forth.

There is another definition of safety culture. It emphasized 6 aspects of safety culture which are safety substance culture, safety conduct culture, safety system culture, safety conception culture, the persistence of safety culture of the system and openness safety culture of the system. The International Nuclear Safety Group (INSAG) has brought a safety culture structure as **Figure 1** for better understanding as below:

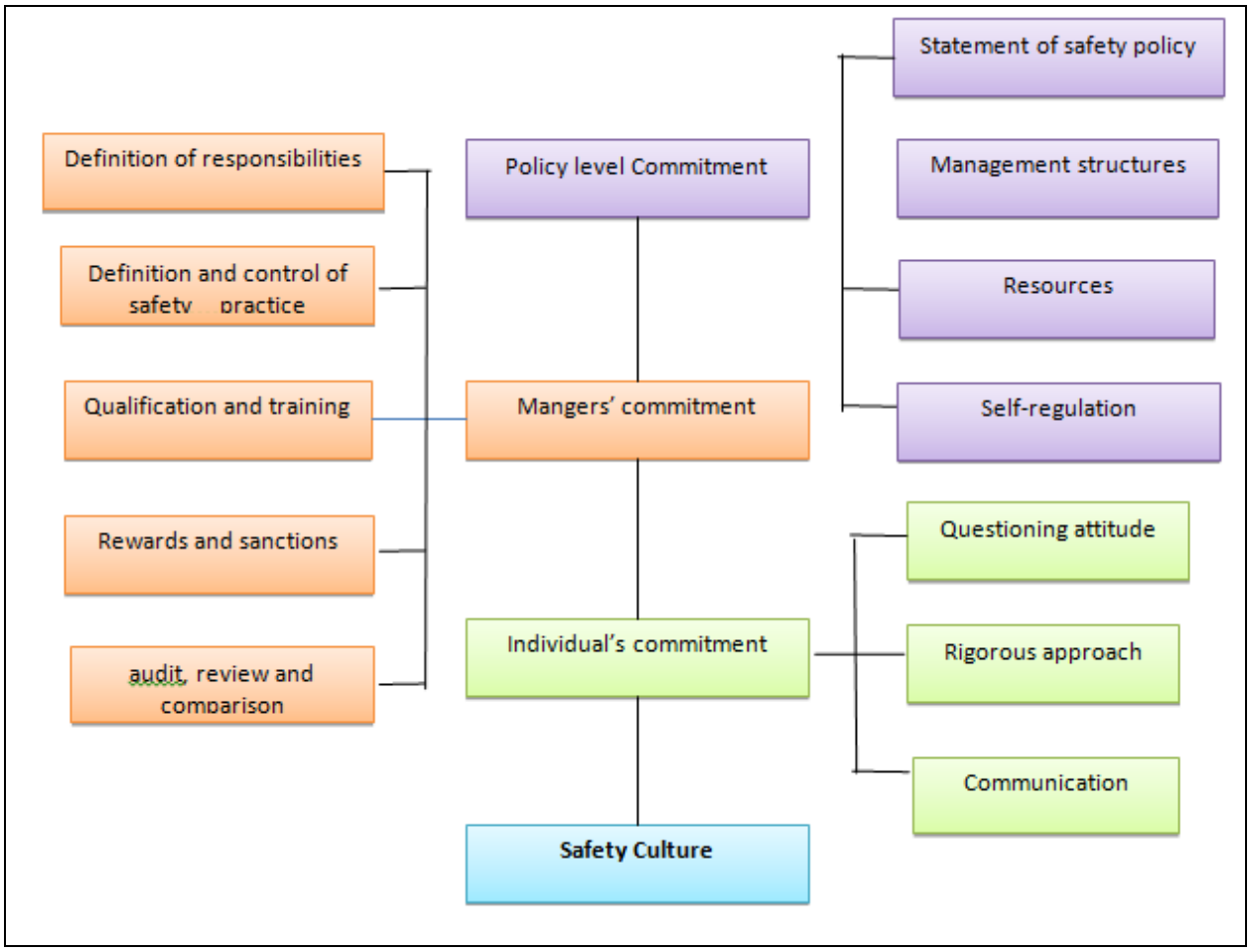


Figure 1: Safety Culture Model purposed by INSAG

In other ways, Safety culture is very crucial to any industries. This is because it is closely related human life. People without any safety conscious will bring themselves in danger position at anytime and anywhere. Hence, safety culture concept should be clearly established at any fields' especially high danger industries such as chemical industry, oil and gas industry and nuclear industry. The consequences of the industry accidents will be severe such as danger to human life, money loss or environment damage such as air or water pollution and so on. To build safety culture on certain industry, it is not easy and it needed takes very long time to collect relevant data and information.

1.2 Chemical Industry in Japan and France

The chemical industries in Japan are considered weak industry compare with automotive and electrical industry. Their international competitive in chemical industry are lower compare with Europe and USA. Recently, it is slowly can see that chemical industry in Japan has substantial potential to become a leading industry. For example: protective film LCD, carbon filters, compound of semiconductor products have larger global share compare with electronic and automotive parts. Second reason of Japan chemical industry less competitive is weak assembly manufacturing in supply chain system. This lead from reasons of low demand of high end products, low costs production in other South East Asia countries and Japan are fall behind by companies from USA and Europe in business models.

In Japanese companies, they prefer reduce payroll and increase operational efficiencies to encourage employee's loyalty to the company. And Japanese companies have low manpower turnover rates. However the strong social pressure against the action of cutting manpower and make it difficult for chemical companies to adapt the diversity environment and closure of chemical plant companies in Japan. Japan chemical industries have tendency of near term of protectionism support from Japan government to set lower cost outside

countries' competition. However, this near term approach might lead to lower their competition with foreign countries in long term growth.

There are few scenarios that Japan has to be take care of in order to overcome the challenge and making chemical industry as next leading industry. Firstly, strategies of change high value-added products to revenues and how Japan chemical industry approach low end market. Taking steps on making partnerships with other countries and finally, focusing more on core business unit.

For countermeasure about Japan government to handle and prevent chemical industries accidents, they established environment law system and legislated the Basic Environment Law .The law include control of industrial emissions, products and waste, implement energy saving, promote recycling, land utilization control, and promote environmental pollution control programs and so on.

In Europe, their world-sales of chemical industry is Europe dollar 1.8 trillion, it is more than 5 % of world GDP in 2004. Europe and USA are majority of global chemical production. Pharmaceutical is one new chemical industry that is in fast growing in Europe and in the world. There are few concerns of French in growing in chemical industry as below:

a) Health hazards - it is related health of workers and consumers from the threatening of continue hazard.
b) In long term, labor are exposed to dangerous chemical including asbestos and cause to occupational and environmental illness
c) Shrinking of labor force due to fast increase productivity of chemical industry. Jobless people are increasing.
d) Chemical residues caused to environment pollution.

The countermeasures of French government are including establish strict law to companies. Companies are in charge of their responsible for ensuring workforce safety. French labors are protected from precautionary approach of chemical safety called REACH. In addition to that, a new method called as “Green chemistry” is created to systematize chemical production, to design new chemical products and reduce output of chemical production. The targets are attempts safer chemical products and select safer ways to synthesis those chemicals. In addition to that, Green chemistry are including reduce waste, increase energy efficiency, recycle concepts, and so on. This Green chemistry created range of economically innovative. Another practice apply in French chemical industry is that government provide first-hand knowledge of environmental information. Establish REACH (European Unions) are established for testing all chemical volume used in industry per year and registration chemical company’s process. And finally Risk assessments which implemented by REACH to judge the possibilities of any accidents happened. Risk assessments are based on several assumptions of exposures, human behaviors, and chemical residues effects. As conclude, French chemical industry is succeeding in global marketplace and their capability to create a safer and healthier environment.

There is some past chemical industry accidents happened in France. For example: Atofina’s AZF fertilizer factory explosion in Toulouse, total 30 persons were killed in this accidents and total 11000 building damaged in this accidents. Black rain happened which cause from released 10 tons of hydrocarbon into to air from Total refinery at La Mede at 2005. It caused 700 house damaged.

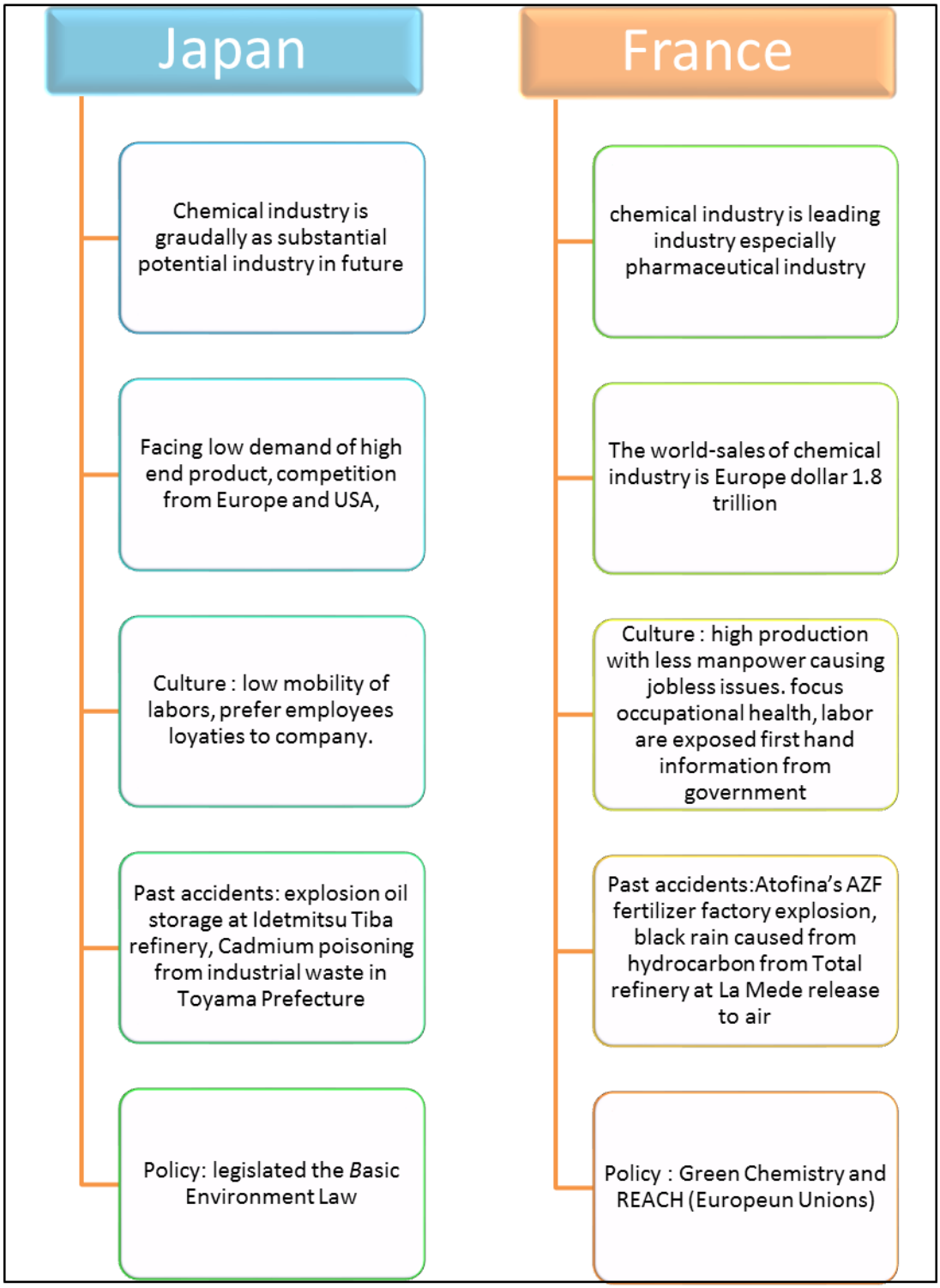


Figure 2: Summary about the Difference Chemical Industry Development between Japan and France

1.3 Safety Culture Structure and Relationship between Individual, Team and Organization In Safety Culture

Safety cultures can be explained details based on organization climates which determines organization overall effectiveness for human relations and minds, another domain is based on organization control which determines the validity of safety mind. These two domains can further classified into 4 subgroups as showed in **Figure 3**. First domain refers to motivation, governance, commitment, and communication For example: governance means control of upper management to workforce on their safety mind, commitment refers to all members of an organization participate on safety culture activities and so on. In addition to that, for communication, it can be described into internal, external communication, and organizational knowledge. Internal communication related safety information exchange, formal or informal within chemical organization and several departments must coordinate their activities in ensuring that plant equipment is operational and productive while external communication refers safety information exchange between chemical plants or organization. And organization knowledge are referring plant personnel understanding about the interaction of organizational subsystem and which work that can accomplished within in an organization or plants

Another domain based on organization Controls which are awareness, learning & training, work practice and resources allocation. For example: Learning & Training refer to Top management provide safety training and practice to their employees to have certain level safety knowledge whereby fit to their duty, in addition training and practice able to provide requisite knowledge and skills to perform work safely and effectively. In term of learning, it is referring to the level to which plant personnel and the organization use knowledge that obtained from history experiences to improve future performance and improvement. Another example is Resource allocation which means proper allocation of the financial, utility, manpower, and chemical resource materials to create systematic and steady system in an organization, additionally, applies both human and financial resources toward the acquisition of communication goals in resource allocation explanation. And all these 8

subgroups are actually related to each other. This safety culture structure we also called as 8 axes model.

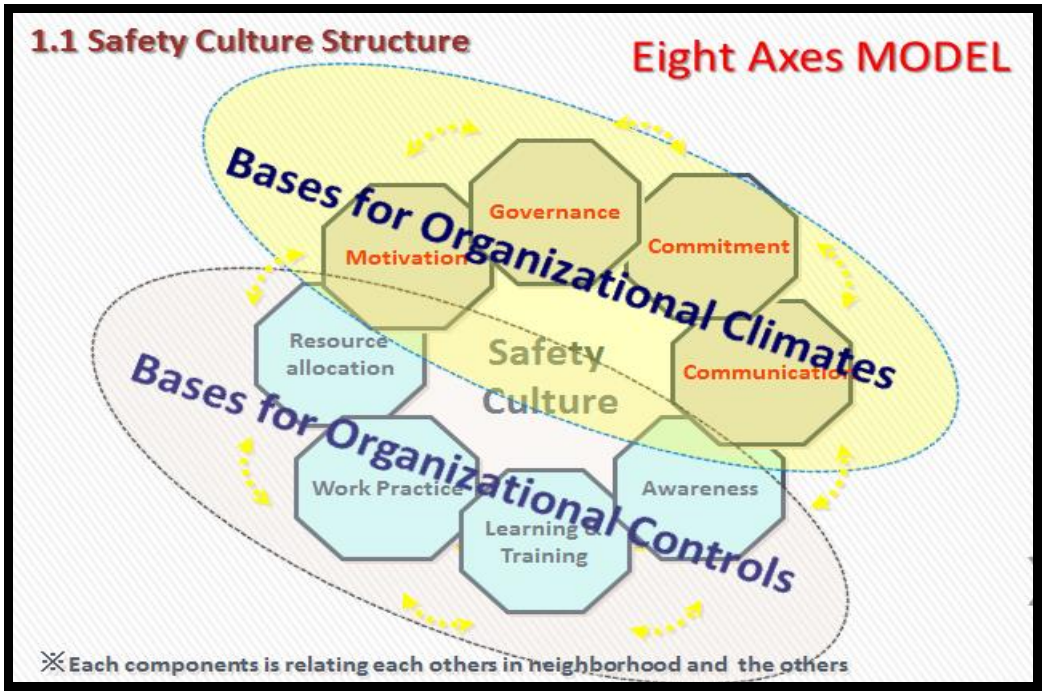


Figure 3: Safety Culture Structure (8 axes model)

In addition to that, there is relationship in individual, work team and organization in building on Safety Culture Assessment System (SCAS) questionnaires are showed in **Figure 3**. These three categorizes are closely relate to each other and they have each function respectively. As explained in individual parts, it emphases on employee consciousness and behaviours by improving safety in own job, making steady endeavour to reduce risks, continue selecting safety side action. Another important part for individual part is enhancing motivation by removing negative factors by participate safety activities and improve organizational circumstance.

In work team, this is very critical on involve safety activities by report accidents to upper management, make visual safety signboards at workplace and always alert to potential problems. In addition to that, good communication relationship in work team is important

by sharing safety information in workplace and having mutual communication beyond organizational Hierarchy.

In discussing of organizational part, it is closely related effect a plant's effectiveness. it is connect with work structure factors, which relate to the way at all levels in chemical organizational is staffed, managed, organized, rewarded and perceived by personnel. Good organization management can be determined whether workforce performance will be effective and reliable under normal or unexpected conditions. In addition to that, organization plays a very important role in safety culture. It refers to top leader's initiative to organize safety activities, giving incentives to employees who have good work performance, implementing cycle of positive and negative discovering and most important it provides effective management such as establish safety team to having regular safety assessment checking at each department about on their how employees perform their duty, machine maintenance, employees safety equipment wearing and so on to make sure employees safety and on reduce the risks in work environment.

Figure 4: Relationship Safety Culture between Individual, Work team and Organization

1.4 Problem Statement

As mentioned earlier, there are various industrial accidents happened due to various reasons, it could be caused by natural disaster for example: earthquake, human mistake, utility function failure, poor working environment for example: poor manage or storage easy burn or chemical, insufficient understanding about safety knowledge of workers, ineffective control from upper management to general workforce about safety training such as wearing of mask or glove when they are expose at high danger chemical or easy burn material. In addition, workers have to have their conscious about their safety activity in their workplace, where they should always alert potential danger of utilities that they use and report to upper management if find out any problem during they perform their job.

Items	Previous research	Current research
1.) Find common SCAS questionnaires between Japan and France	X	O
2) Determine common SCAS questionnaires between Japan and France	X	O
3) Identify and grouping common SCAS questionnaires into SCAS model	X	O
4) Find standard value in correlation analysis as that used to identify effective SCAS questionnaires	X	O
5) Validation result from Japan Chemical Company A by principle component analysis	X	O

Table 1: Comparison between Previous Research and Current Research.

Since, we see and hear those industrial accidents from past history. There are many enterprise's factories in chemical industry were stationed at whole of the world. Each

company has their own countermeasure to solve that particular accident only. Each company at different countries may have their own safety policy. With this, any industrial accidents will happen continually. Hence, a proper Safety Culture Assessment System (SCAS) questionnaire which can be extended to world-wide should be established to assess safety level of their factories.

1.5 Hypothesis

The hypothesis of this research is expected able to find common and effective or Integrated Safety Culture Assessment System (SCAS) questionnaires between Japan and France by using data from Japan chemical company A. From this, it is expand to proper SCAS questionnaires structure for both countries as one of global SCAS candidate in worldwide chemical industries. This study is expected able to identify those common and effective SCAS questionnaires between Japan and France

After that, this research will use 800 sample data from Japan Chemical Company A. And 86 Japanese companies and around 20 France's companies' accident rate data to neglected questions in SCAS questionnaires. And a standard significant value from correlation analysis is studied as a standard value to define SCAS questions quality and value. Finally, Final Integrated SDM or ICSI SCAS Questions will be validated with 20 sections of Japan Chemical Company A by using principle component analysis.

2.0 Purpose of Study

The main purpose of this research is to purpose new questionnaires system or new questionnaires structure by comparison of Japanese and French Safety Culture Assessment System (SCAS) and establish Integrated SCAS questionnaires in chemical industries for both countries as benchmark SCAS questionnaires that can be used for worldwide chemical industries application in future

After that, extend these Integrated SCAS questionnaires structures between Japan and France countries as toward to global Safety SCAS questionnaires in future. France has been choosing for corporate with Japan toward global safety culture assessment. The main reason is that Keio University and INSA University has tight relationship. ICSI is a non-profit international organization that focuses on safety assessment program and ICSI approached to SDM for having collaboration study about develop global safety culture assessment system questionnaires.

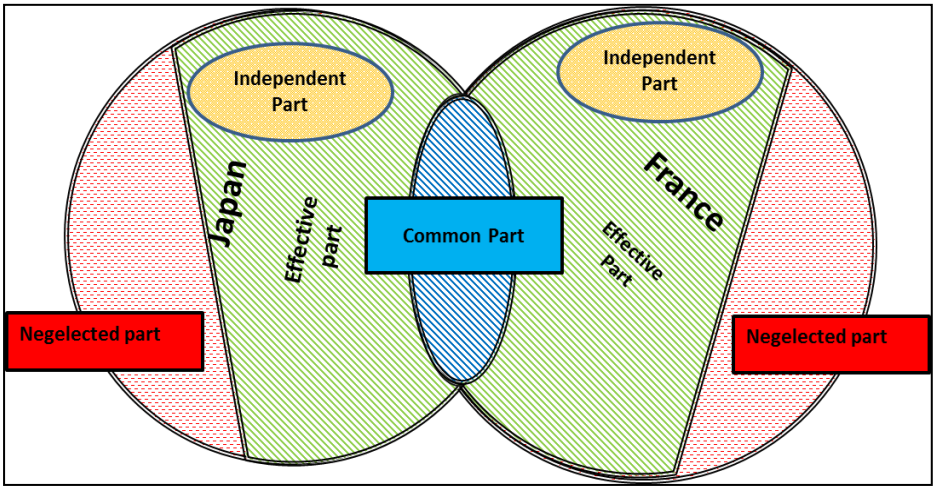


Figure 5: Model of Safety Culture Assessment System (SCAS)

From the model of SCAS in **Figure 5**, the red part is neglected part of questionnaires. The questions in this area can be deleted or ignored. Those questions in neglected part are unable to assess safety level of company effectively. The orange colour area is independent question areas, independent questions are important to determine the different of safety culture between Japan and France and it can be candidate questions as innovative SCAS questions either. The green part from the model SCAS, it is effective SCAS questionnaires in each Japan and France country respectively. The middle blue part is common effective questionnaires between Japan and France. And again to emphasis for this study is that to find Integrated SCAS between Japan and France which as one of candidate toward to achieve SCAS for world-wide application. Below diagram **Figure 6**, the yellow part showed that Integrated SCAS questionnaires that can be used to determine safety level of chemical companies in Japan and France.

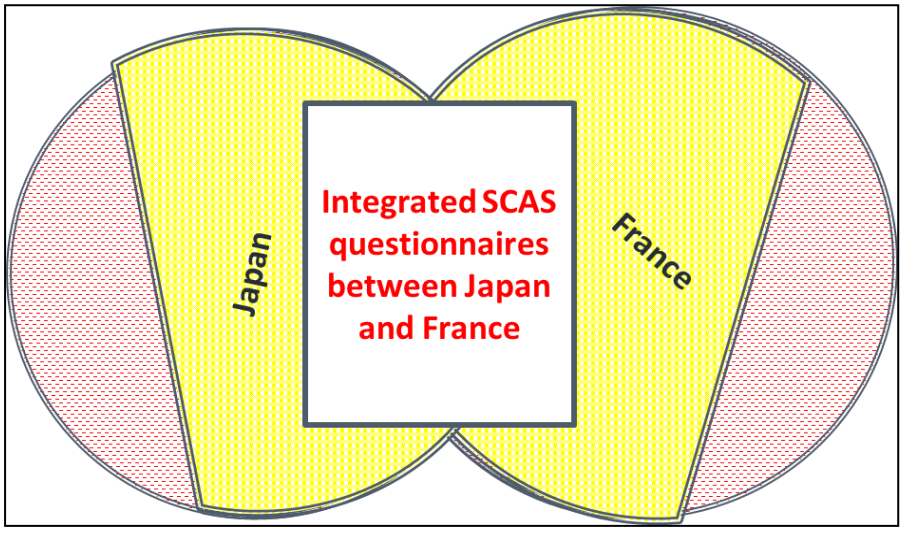


Figure 6: Model of Integrated Safety Culture Assessment System (SCAS) Questionnaires between Japan and France

3.0 Methodology of Questionnaires, Research Progress, and Data Criteria

3.1 Methodology of Questionnaires

Japan Chemical Company A employees are participated in this research. There are 800 data are collected from Japan chemical company A. Japan chemical company A employees answered both questionnaires prepared from Japan, System Design & Management (SDM) 110 SCAS questionnaires and France, The Institute for an Industrial Safety Culture (ICSI) 83 SCAS questionnaires. After that, regression and multivariate analysis are using to apply on questionnaires data that is collected from Japan Chemical Company A. It is expected that, it can find out the common and correlation questionnaires from the analysis data result between both countries.

3.2 Research Procedures

800 data from Japan chemical company A was collected. Japan chemical Company A employees answered Safety Culture Assessment System (SCAS) questionnaires from SDM and ICSI. There are some questionnaires answer sheet score had been reversed is to detect employees read and answer questionnaires with honestly, also those reversed score questions are negative expression sentences in SCAS questionnaires both in SDM and ICSI. For SDM questionnaires, total 18 Safety Culture Assessment System (SCAS) questions numbers are 8, 18, 26, 27, 40, 44, 46, 49, 51, 52, 70, 74, 84, 85, 87, 89, 92 and 110 had been reversed its score while total 26 Safety Culture Assessment System SCAS ICSI reverse score of questions numbers are 23, 31, 35, 37, 39, 40, 41, 45, 46, 54, 56,58, 64,67, 77, 80, 85, 87, 89, 93, 94, 96, 101, 110.

This research is to find out relationship between SDM SCAS questionnaires and ICSI SCAS questionnaires by using correlation bivariate analysis and manual analysis. It is expected to find the significant correlation value that can be used as standard significant value to determine effectiveness SDM SCAS questionnaires and ICSI SCAS questionnaires. In order to arrange the data for proper analysis, SDM SCAS questionnaires (110 questions) and ICSI SCAS questionnaires (83 questions) will arranged into 5 categorize. First category is select common questions from SDM SCAS questions and ICSI questions which are supported by semantic and static analysis. Second category is selecting questions which are strong in semantic analysis but weak in statically. Third category is selecting questions which are weak in semantic analysis but strong in statically. And fourth and fifth categories are SDM questions and ICSI questions that do not have any correlation signification value to each other.

From data arrangement, it can be determined SDM SCAS and ICSI SCAS questions into common area, independent area, effective area of SDM and ICSI respectively and neglected area in SCAS structure. In common questions, there is extra expert analysis into three ways. First, identify question pairs that completely same safety concept between SDM and ICSI SCAS questionnaires. Second, remove one question from duplicate question pairs that have poor expression in safety concept. And third remove additional neglected questions from common questions that judged by accident rate and expert. Finally, this research will validate Integrated SCAS questions between Japan and France by principle component analysis with using 20 divisions' data of Japan Chemical Company A.

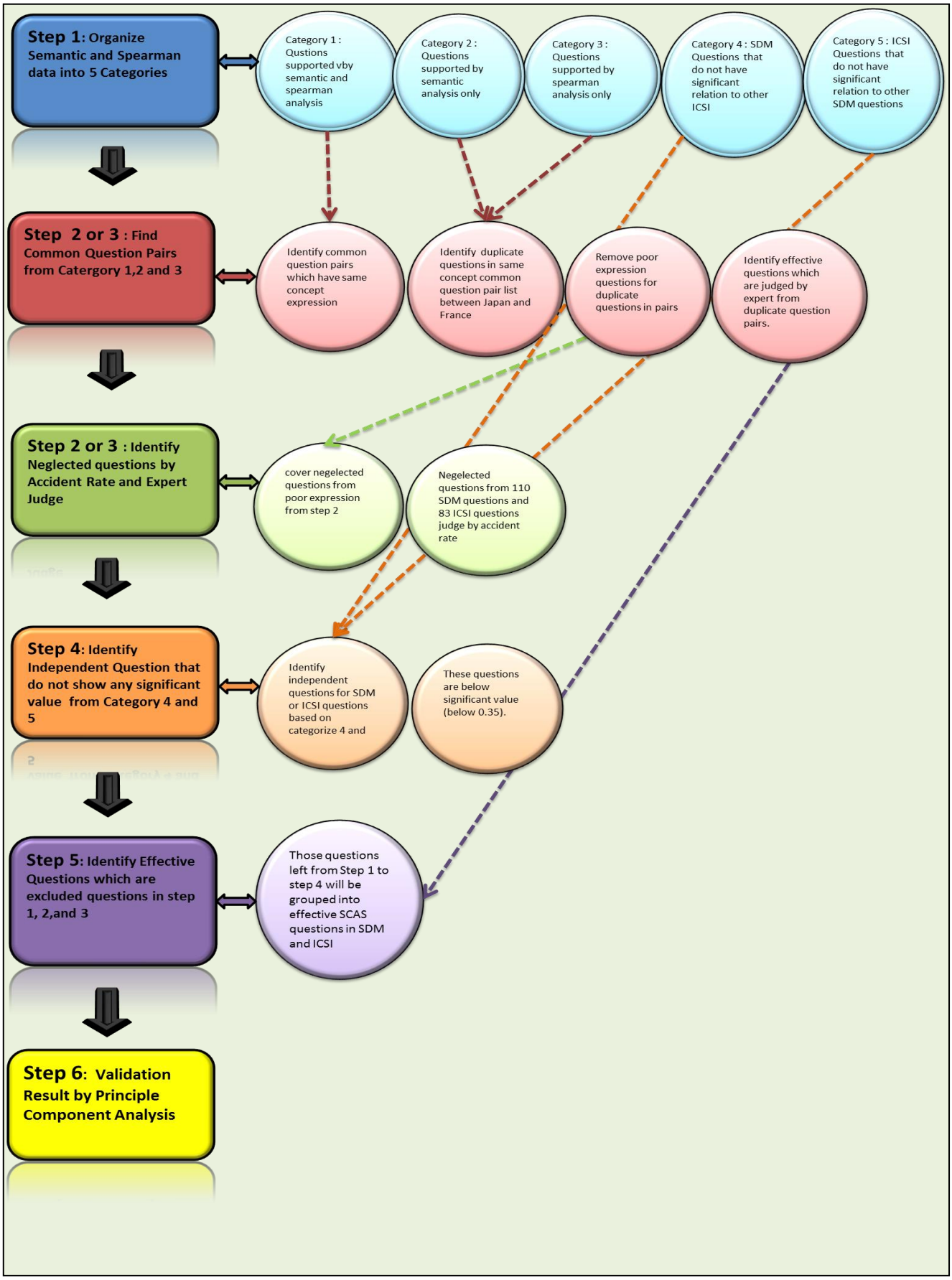
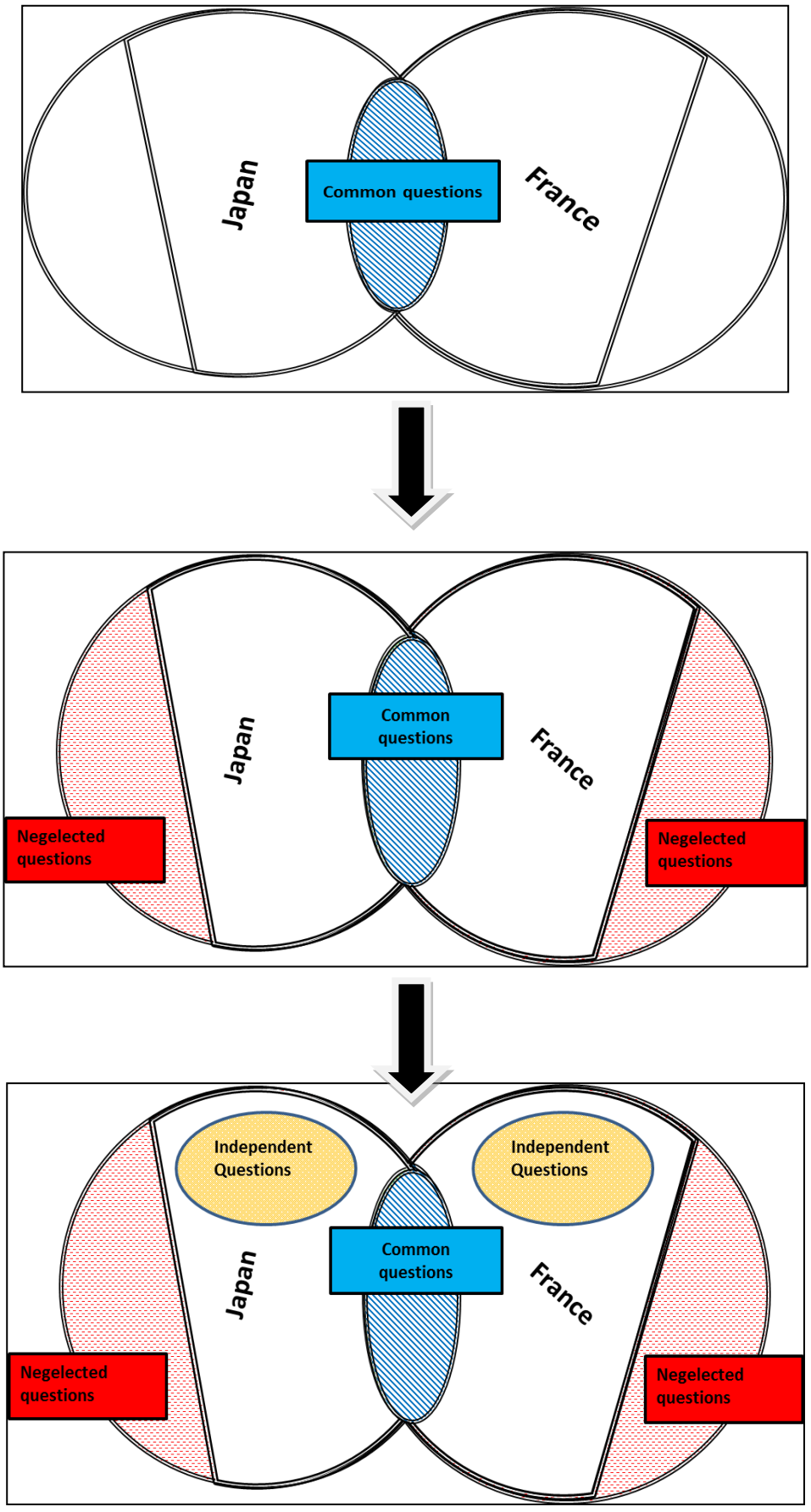


Figure 7: Summary of Research Procedure


Japan
Common questions
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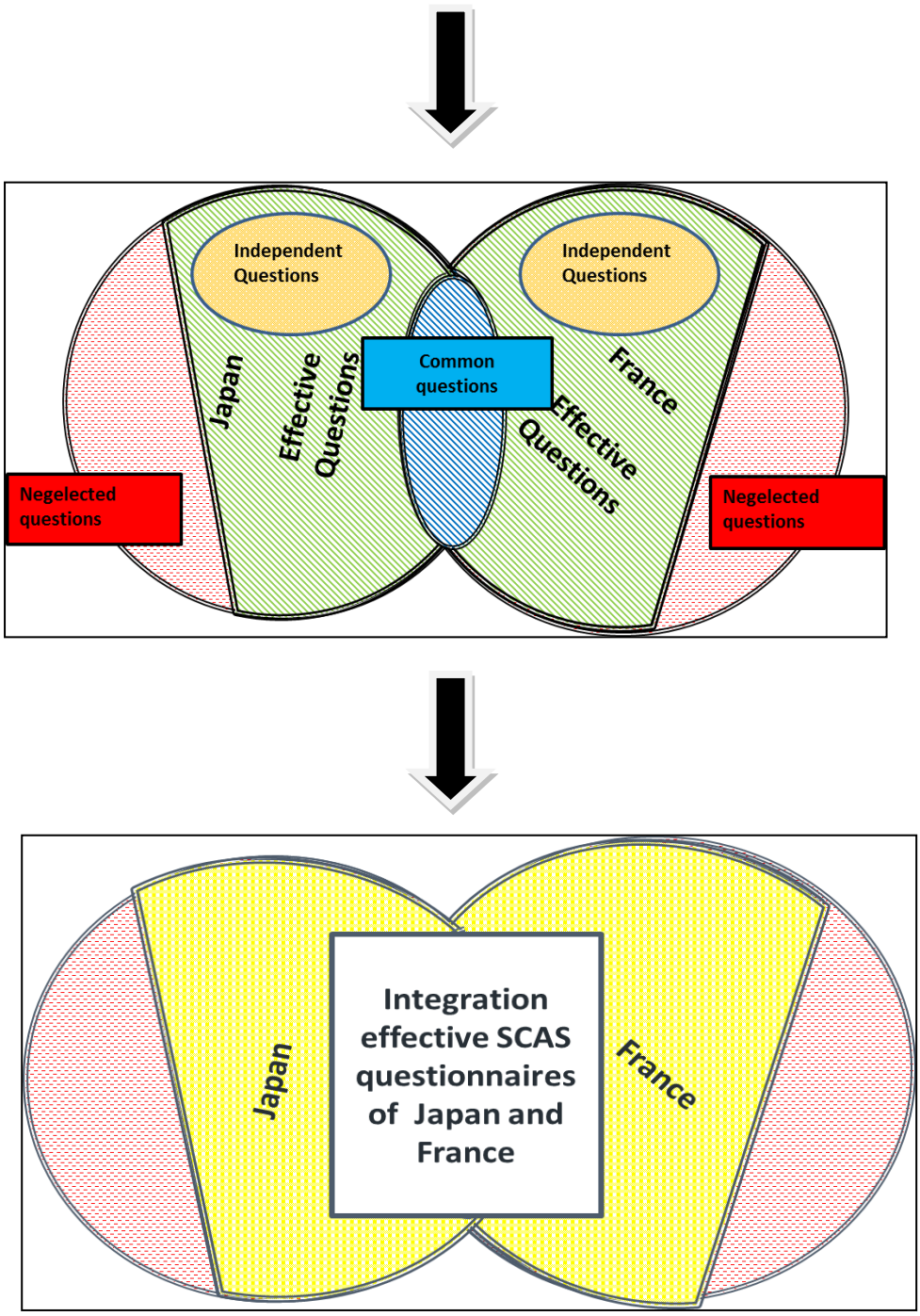


Figure 8: Research Procedure Diagram Flow

3.3 Data Criteria

Japan chemical company A participate on this research, there is total 800 employees in Japan chemical company A answered both 110 Japan Safety Culture Assessment System (SCAS) questionnaires and 103 France Safety Culture Assessment System (SCAS) questionnaires. Below are data criteria from Japan chemical company A.

No	Items	Criteria
1.	Total employees participated	800 people
2.	Attempt of survey	2nd attempt
3.	Age range of participants	20 to over 61 years old
4.	Division code	20 Division codes involved (note 1)
5.	Section code	General, IP testing, IP section, Technical, General management, Utility, BTX.AO
6.	Gender	780 males and 20 females
7.	Seniority	Less than 3 years to over 41 years
8.	Shift worker	Night shift, daytime shift and other
9	Responsibility	Field operation, central operation, field task, maintenance, Planning/Management, Field Supervision, HSE and other technical work
10.	Position	From general workforce to Division manager (note 2)
11.	Axis	Governance, commitment, communication, motivation, risk management, learning & Training, awareness, effective management
12.	Questionnaires score	5: Strongly Agree; 4: Agree; 3: Neutral; 2: Disagree; 1: Strongly Disagree.

Table 2: Data Criteria

*note 1: 20 Division codes involved are plant, Top management, HSE division, Production Planning Division, Maintenance division, Quality Assurance division, Butanediol production, polyolefin planning division, polymer production, polystyrene production, chemical production 1 & 2, Ethylene production division, polyethylene production system, functional resin production division 1 &2, , functional chemical production division, compound production division, machinery division and instrument division.

*note 2: Positions of Japan Chemical Company A are included Division manager, section manager, supervisors, technical staffs, general workforce and others.

4.0 Analysis and Discussion

In this section, research analysis will be showed and discussed as V-model below:

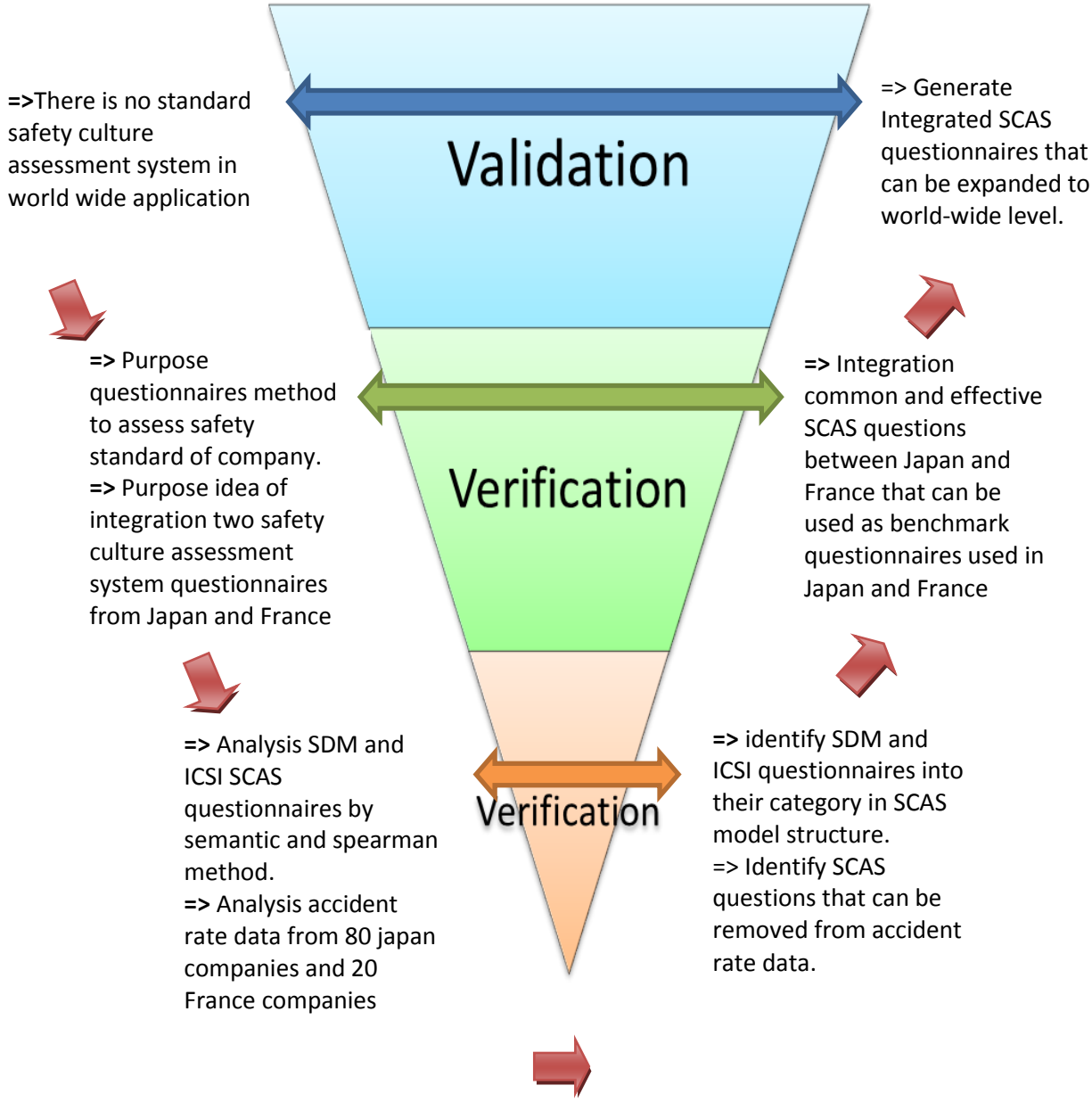


Figure 9: V-model of SDM and ICSI SCAS Questionnaires

Following analytical results list will be presented on this research:

4.1 Introduction SDM Questionnaires into its 8 axes

4.2 Introduction ICSI SCAS Questionnaires System

4.3 Sematic Similarity Result

4.4 Spearman analysis and significant correlation score determination result

4.5 Introduction of SCAS model structure

4.6 List of Type of Common Questions between Japan and France

4.7 List of SDM SCAS Questionnaires into SCAS model Structure

4.8 List of ICSI SCAS Questionnaires into SCAS model Structure

4.9 Summary result of overall SCAS Distribution Result

4.10 Integrated SCAS questions as benchmark questionnaires that can be used for Japan and France's chemical industry application in future

4.11 Verification result by principle component analysis

4.1 Introduction SDM Questionnaires into its 8 axes

Safety Culture Assessment System (SCAS) questionnaires are made based on safety culture structure which included 8 axes model: 1.Governance, 2.Committment, 3.Resource Management, 4.Motivation, 5.Learning, 6.Awareness, 7.Communication, and 8.Learning.
And also SCAS questionnaires are divided into 3 categorize: 1.Individual, 2.Level, and 3.Management. Below are SDM and ICSI questionnaires list into their category system.
(Please refer table 18 at appendix)

8 axes model

1	Governance
2	Commitment
3	Resource Management
4	Motivation
5	Learning
6	Awareness
7	Communication
8	Learning

3 main levels

1	Individuals
2	Team
3	Management

4.2 Introduction ICSI SCAS Questionnaires System

Indicator		Type
1		Risk (answer score 1 to 3)
2		Risk (answer sheet score from 1 to 4)
3		Culture (answer sheet score from 1 to 4)
4		Perception (answer sheet score from 1 to 4)

(Please refer table of ICSI SCAS Questionnaires System in appendix)

ICSI has it's categorize for their Safety Culture Assessment System (SCAS) questions into 9 main groups. The main groups are as following:

(Please refer table of ICSI SCAS Questionnaires System in appendix)

1) Organization and work content
2) Management Leadership
3) Technical Safety Management
4) Ergonomics and Engineering
5) Behavioural Safety Management
6) Work Team/Peers influence
7) Employees Behaviours
8) Health
9) Environment

1. Organization and work content

- I. Preservation of employment - Q185R
- II. Preservation of Competencies - Q135
- III. Relationship - Q132, Q133, Q136
- IV. Work Stress/Pressure - Q131R, Q137
- V. Management Style - Q146R, Q160, Q184

2. Management Leadership

- I. Top Management's attitude - Q166, Q178
- II. Line Management's attitude - Q159, Q167
- III. Credibility - Q162, Q170
- IV. Clarify of Messages - Q177R, Q194R

3. Technical Safety Management

- I. Promotion of Report - Q165
- II. Investigation, analysis, feedback - Q138, Q147, Q164R,
- III. Action Taking - Q162, Q172, Q207
- IV. Downgraded Situation-Q145R, Q149
- V. Promotion of Report - Q165, Q149
- VII. Work Permit - Q150
- VIII. Risk Management - Q142, Q152, Q153

4. Ergonomics and engineering

- I. Ergomics of Work Situation - Q134, Q187R
- II. Ambient Factos - Q154R

5. Behaviour Safety Management

- I. Rules qualities and work permits - Q139R, Q149
- II. Recommendation - Q171
- III. Training of employees - Q209, Q186, Q203, Q206
- IV. Supervision - Q163, Q168, Q180R
- V. Positive reinforcement sanction policy - Q143, Q173, Q164R, Q189R, Q212
- VI. Partipatory management - Q199, Q190, Q183, Q184, Q160, Q147

6. Work Team/ Peers Influences

- I. Work team relationship - Q132
- II. Mutual Aid - Q192, Q195, Q200
- III. Peer Couching - Q202
- IV. Group Orientation - Q151, Q162

7. Employees Behaviours

- I. Employees attitude - Q188, Q209
- II. Reporting - Q201R
- III. Housekeeping - Q141R
- IV. PPE Wearing - Q191
- V . By Pass - Q193R, Q196R, Q198R, Q213
- VI. Involvement - Q67, Q148

8. Health

- I. Action Efficiency - Q175
- II. Information and training of employment - Q206
- III Compliance with rules - Q205
- IV. Ergonomics - Q187R, Q154R
- V. Risk Management - Q153
- VI. Anxiety - Q185R, Q137, Q135
- VII. PPE Wearing - Q191

9. Environment

- I. Action Efficiency - Q154R
- II. Information and Training of Employees - Q203
- III. Compliances with rules -Q213
- IV Risk Management

Table 3: ICSI Safety Culture Assessment System (SCAS) Questionnaires Main Groups.

4.3 Sematic Similarity Result

In this section will be discussed and analysis common or similar questionnaires between SDM Safety Culture Assessment System (SCAS) questionnaires and ICSI Safety Culture Assessment System (SCAS) questionnaires that were judged by both SDM and ICSI point of view.

**** Please refer ICSI questionnaires on Table 20**

Indicator

	Strong sematic question relationship between SDM and ICSI

No	**SDM SCAS Questionnaires**	**ICSI Judgement of SDM Questionnaires relative ICSI Questionnaires****		**SDM Judgement of SDM Questionnaires relative to ICSI Questionnaires****	
		Same	**Similar**	**Same**	**Similar**
1	The company makes consideration to create a pleasant work atmosphere for sub-contacting employees.	-	-	-	-
2	Teammates are highly motivated to work together focused on improvement.	-	Q50, Q91	-	Q50
3	I do not hesitate to communicate about my concerns and request with colleague.	Q24	Q25	Q24	-
4	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	Q53	Q83, Q84	Q53	Q83
5	Interpersonal relations between employees are good at this worksite.	Q24	-	Q24	-
6	Employees are able to freely express their opinion regardless of their position or experience.	-	Q74	-	Q28
7	Supervisors / managers have good understanding of their employee's jobs / responsibilities / progress.	-	-	-	Q28
8	Some departments or individuals use too much overtimes to perform their jobs.	-	-	-	Q61
9	Sub-contractor employee receives sufficient training on the safety.	-	Q77	-	-
10	The sub-contracting company is implementing its own safety activities.	-	-	-	-
11	There are some formal and informal events that company and sub-contracting company	-	Q84	-	-

	employees can attend.				
12	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	Q40	-	Q40	Q95
13	During On the Job Training, safety is highly emphasized as very important.	Q64	Q70	-	Q77,Q75 ,Q 98
14	Rules and procedures are properly revised, understood and used.	Q32	-	Q32	-
15	In order to improve operational skills, one-on-one guidance is given by experienced co-workers.	-	Q91	Q98	-
16	Important technical skills must be listed, and program is in place to transmit this information without any omissions.	-	Q27	-	Q27
17	For planning maintenance shutdown, previous accomplishments are considered.	-	Q40	-	-
18	Role and responsibilities are ambiguous within the workplace.	-	-	-	-
19	Employees are open to changes and modification of organization and system.	-	Q95	-	-
20	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	Q43	-	Q43	-
21	During discussion with management, employees have clear understanding of personnel evaluation and goals.	-	Q28	-	Q28
22	Employees always work hard for continuous improvement.	-	Q50	-	Q50 ,Q93
23	Management participates in safety education and training with constructive manner.	Q63	Q70	Q63	-
24	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	Q58, Q97	Q40, Q81	-	-
25	People collaborate to help each other when work is unbalance between departments or employees.	Q91	-	-	-
26	There are too many useless or inefficient meetings.	-	Q86	Q86	-
27	There is an age imbalance in the composition of the employees and the transition of technical skills cannot be completed smoothly.	Q98	-	-	Q98
28	Technical information is shared between maintenance department and operations department.	-	Q25	-	Q25
29	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	Q49	Q67	-	Q42, Q43 , Q79

30	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	-	Q41	-	Q41
31	Good housekeeping / storage and work area organization is in place.	Q34	-	Q34	-
32	Hazardous areas and operational hazards are properly labelled to make people aware.	-	Q79 ,Q102	-	-
33	Best safety measures and practices from other plants/other companies are introduced and implemented.	-	-	-	-
34	Experience related to past accidents, incidents and human behaviours are taken in consideration in work standards and procedures.	-	Q40	-	Q40
35	There are systematic skills training programs available which people can attend based on their skill level.	Q102	Q77	-	-
36	Good conditions of equipment (such as the pumps) are continually inspected, and any abnormalities are reported.	-	Q37	-	-
37	Initiative and attitudes for safety actions are promoted and included in the personnel evaluations.	Q73	Q59	Q73	-
38	Safety initiatives are shared with entire workforce, and excellent actions are acknowledged.	Q73	Q59 , Q70	Q73	-
39	Any concerns and/or requests from the sub-contractors are reported to the company management and are promptly taken care of.	-	-	-	-
40	Non real information and rumours are incorrectly reported.	-	Q81, Q97	-	Q58, Q81, Q97
41	Managers and employees try to reduce amount of work by revising or streamlining work and procedures.	-	Q39, Q55	-	-
42	Managements and supervisors take serious consideration about your job and your future.	-	-	-	-
43	Job evaluation by management takes in consideration both positive and negative.	-	Q36, Q73	-	-
44	Employee could be blamed after an incident caused by personal error or mistake.	Q57	-	Q57	-
45	The labelling, colour code, signs and hazard limits are consistent.	-	-	-	-
46	Equipment and installation were used passed their service life.	Q38	Q37	Q38	-
47	Management of change for equipment and procedures are clearly defined and implemented.	-	Q48	-	-
48	When implementing change, permission by expert supervisor is required.	Q43	-	-	Q43
49	Work habits take priority over rules and	Q92	Q89, Q90	Q92	-

	regulations.				
50	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	Q74, Q93, Q95	Q53	Q74	Q53, Q95
51	In case of new installation or maintenance, review procedures are insufficiently organized.	-	-	-	-
52	Equipment is operated systematically above normal design conditions.	-	-	-	-
53	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	-	Q42	-	Q42
54	There are systematic symbols/numbers labelled on the important components, such as valves/plumbing/pumps, and it coincides with the P & ID.	-	Q35	-	-
55	The important valves are labelled with tags (Open/ close/ do not operate).	-	-	-	-
56	Lockout / tag out procedures are used during work, and permission is granted by the shift supervisor.	-	Q43	-	Q43
57	The environmental conditions of the work area are in accordance with regulated occupational health standards.	Q48	-	Q48, Q49	-
58	There is a system in place to report, handle and revise noncompliance situation.	Q66	Q58	Q66	Q58
59	Process risk assessment method as HAZOP is used to assess risk of equipment / installations.	-	Q35	-	-
60	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	Q97	Q58	Q97	Q58
61	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	-	Q35, Q43	-	-
62	Accident and incidents records are organized in database and used for daily safety activities or training	Q40	Q31	-	-
63	My supervisor/management trusts my technical strengths/abilities.	-	-	-	-
64	I get satisfaction from my job.	-	-	-	-
65	Participating in symposiums/conventions/seminars related to safety is encouraged.	-	-	-	-
66	I actively participate in safety training.	-	Q79	-	Q79, Q80
67	I trust the sub-contractors technical competency.	-	-	-	-
68	During preparation execution phase, supervisors/management gives me appropriate advice.	-	Q43	-	-

69	I respect my supervisors/management because he/she have deep experience and effective skills.	-	Q50, Q91, Q98	-	-
70	There are many unnecessary routine tasks that were not originally part of my responsibilities.	-	-	-	-
71	Safety training and education are useful and efficient.	-	Q77, Q79, Q99,Q102	-	Q41
72	Necessary manuals / diagrams / information are easily accessible.	-	-	-	-
73	I immediately take action to solve unclear situation during daily work.	-	Q62, Q65	-	-
74	I take priority to finish a task quickly rather than completing task using a safe and reliable method.	Q52	Q23, Q39,Q55, Q68, Q90 ,Q94, Q101	Q89	Q92, Q94
75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	-	Q80 ,Q85	-	Q80, Q89
76	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	-	Q52, Q80	Q52, Q90	-
77	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	Q73	Q84	Q73	Q84
78	I actively participate in small group activities within my workplace.	-	Q74, Q86, Q95, Q75	-	-
79	I actively share beneficial information with everyone.	-	Q50, Q91, Q93, Q96	-	-
80	There is a systematic training program to improve expertise on specific installation.	-	-	-	-
81	I often visit on-site to find anomalies in equipment.	-	Q58, Q74	-	-
82	I always use standard operation procedures and checklists.	Q18,Q20, Q92, Q101	Q22, Q90, Q94	Q18, Q92	Q90
83	Standard operation procedures are well designed and easy to use.	Q32	Q92	Q32	Q92
84	There are opportunities for us to bypass safety rules under time pressure or non-essential rules.	Q89	Q80	Q89	Q80
85	I believe that professionals are able to perform even dangerous work.	Q15, Q17, Q82	-	Q15, Q82	-
86	All decision makes to satisfy company needs.	-	-	-	-
87	Decisions made by the management always right.	-	-	-	-
88	In case of concern or safety issues, budgets are always available.	Q55	Q63, Q68	Q55	-
89	Issue related to on-site safety solved by each department and not reported to HSE department.	-	Q62, Q81	Q97	Q58
90	Talented people are promoted in the HSE department.	-	-	-	-

91	Our company has a system to develop HSE specialists.	-	-	-	-
92	Important operational tasks are outsourced to sub-contractors.	-	Q39	-	-
93	There is someone responsible to give advice about industrial safety laws and regulations.	-	-	-	Q95
94	Employee can apply for new job or position through in-house staff recruitment system.	-	Q54, Q75	-	-
95	Senior experts considered and developed based on their experience and skills.	-	-	-	-
96	Coordination, collaboration and communication between departments are good.	Q25	-	Q25	-
97	Safety practices and activities are shared internally and externally during meeting.	Q86	Q53	-	Q25
98	Top management communicates and show that they put a high priority on safety.	Q59	-	Q59, Q70	-
99	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	-	Q67	-	Q65
100	The safety practices and action plans are discussed with employees.	-	Q53, Q75, Q95	-	Q74, Q86
101	Safety performance (number of accidents/safety actions/safety budget) is communicated with workforce and used to revise next year plan.	-	-	-	-
102	Top management visit workplace to communicates and share values on safety with employees.	Q72	-	Q72	Q61
103	Management communicate directly with employees about safety actions.	Q61	Q72	Q72	Q61
104	The salary structure corresponds to the quality and quantity of work.	-	-	-	-
105	Headquarters auditors are also invited to perform safety audits based on standards.	-	Q47, Q48	-	Q47
106	During safety audits, working conditions on workplace and safety concerns are grasped through questionnaire or interviews.	-	-	-	-
107	The company has prepared some easy to use document to inform about safety rules and prohibited activities.	-	-	-	-
108	I'm comfortable with my responsibilities.	-	-	-	-
109	Company work satisfaction surveys are conducted and improvement measures are implemented based on feedback.	-	-	-	-
110	Downsizing or personnel job reduction have occurred at your company.	-	Q27,Q39	-	Q76

Table 4: Similarity Analysis Questionnaires between SDM and ICSI

From above **Table 4**, it is found the common safety culture assessment system (SCAS) questionnaires between SDM and ICSI by manually. Each question from SDM and ICSI are discussed 5 minutes by SDM‘s expert and France’s expert and make comparison whether each questions are related to each other. It is final agreement and discussion about semantic analysis between SDM and ICSI

No	SDM SCAS Questionnaires	ICSI SCAS Questionnaires
1	Q2	Q50
2	Q3,Q5	Q24
3	Q4	Q53,Q83
4	Q8	Q39
5	Q12	Q40
6	Q14	Q32
7	Q16	Q27
8	Q19	Q75
9	Q20,Q48,Q56	Q43
10	Q21	Q28
11	Q22	Q55
12	Q23	Q63,Q70
13	Q26	Q86
14	Q27	Q98
15	Q28,Q96	Q25
16	Q30	Q41
17	Q31	Q34
18	Q34	Q40
19	Q37,Q38	Q73
20	Q40	Q81,Q97

21	Q46	Q38
22	Q49	Q92
23	Q50	Q74,Q93,Q95
24	Q53	Q42
25	Q57	Q48
26	Q58	Q58,Q77
27	Q60	Q58,Q97
28	Q66	Q79,Q80
29	Q75	Q80
30	Q76	Q52
31	Q77	Q73,Q84
32	Q83	Q32,Q92
33	Q84	Q89
34	Q88	Q55
35	Q98	Q59
36	Q102,Q103	Q72
37	Q105	Q47

Table 5: Summary Common SDM and ICSI SCAS Questionnaires

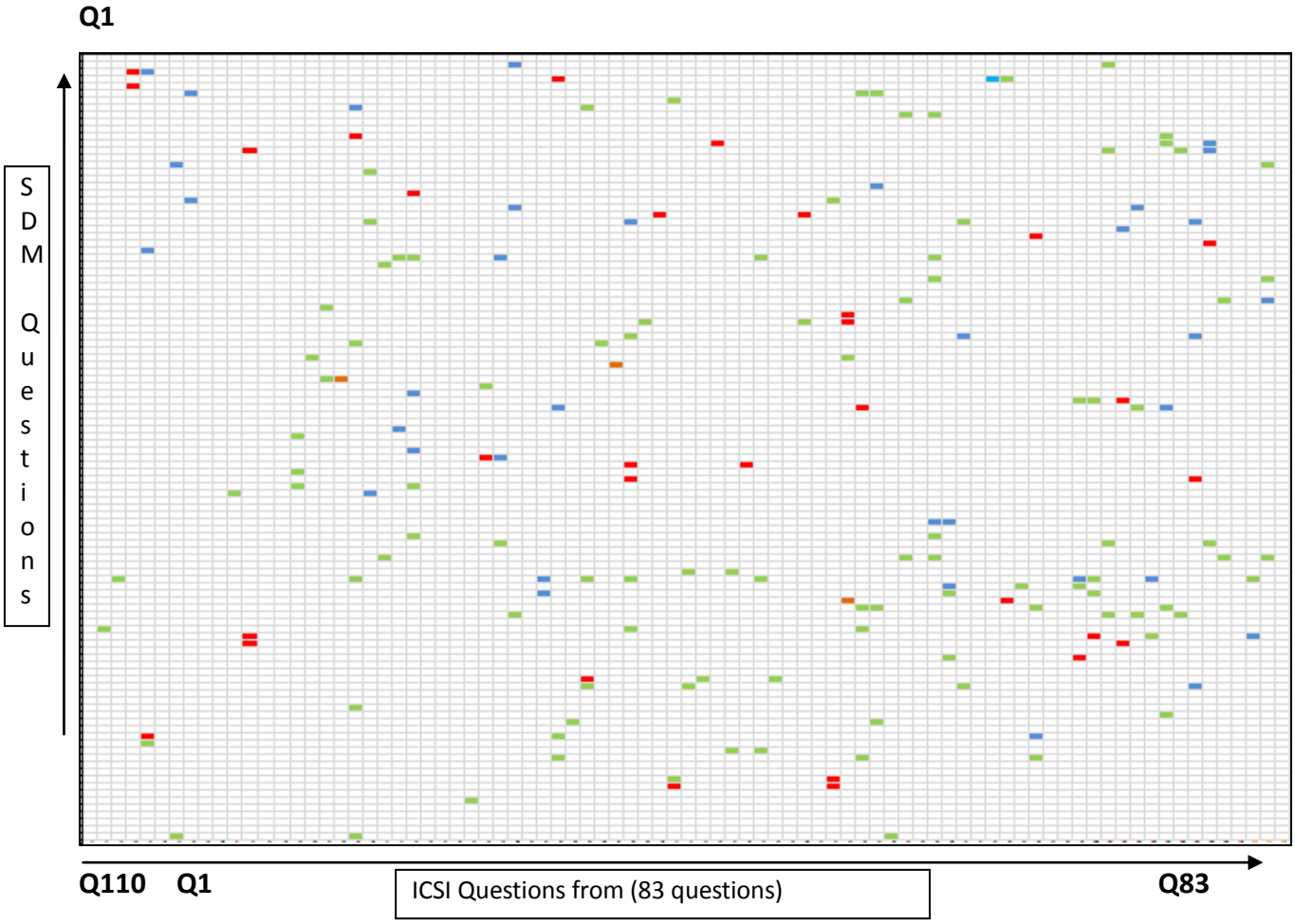


Figure 10: Correlation Analysis Manually between SDM and ICSI SCAS Questionnaires

	strong relation	both same or same/similar
	Relation	either same /both similar
	weak relation	either similar
	no relation	no

4.4 Correlation Analysis and Significant Correlation Value Determination Result

In this section, it is able to find out correlation bivariate by correlation analysis method to find out the relationship between SDM Safety Culture Assessment System (SCAS) questions and ICSI Safety Culture Assessment System (SCAS) questions. And Find out standard references value as significant correlation score that could be used to references score to determine the how strong SCAS questionnaires relationship between Japan and France

Below is correlation analysis data setting:
Total data = 9130 data (SDM 110 Questionnaires x ICSI 83 Questionnaires)
Maximum value=0.585, Minimum value= -0.263 and average value=0.195
Significant correlation value = 0.35

From **Figure 11** below, it showed result correlation SDM SCAS Questionnaires and ICSI SCAS Questionnaires by using Correlation analysis result.

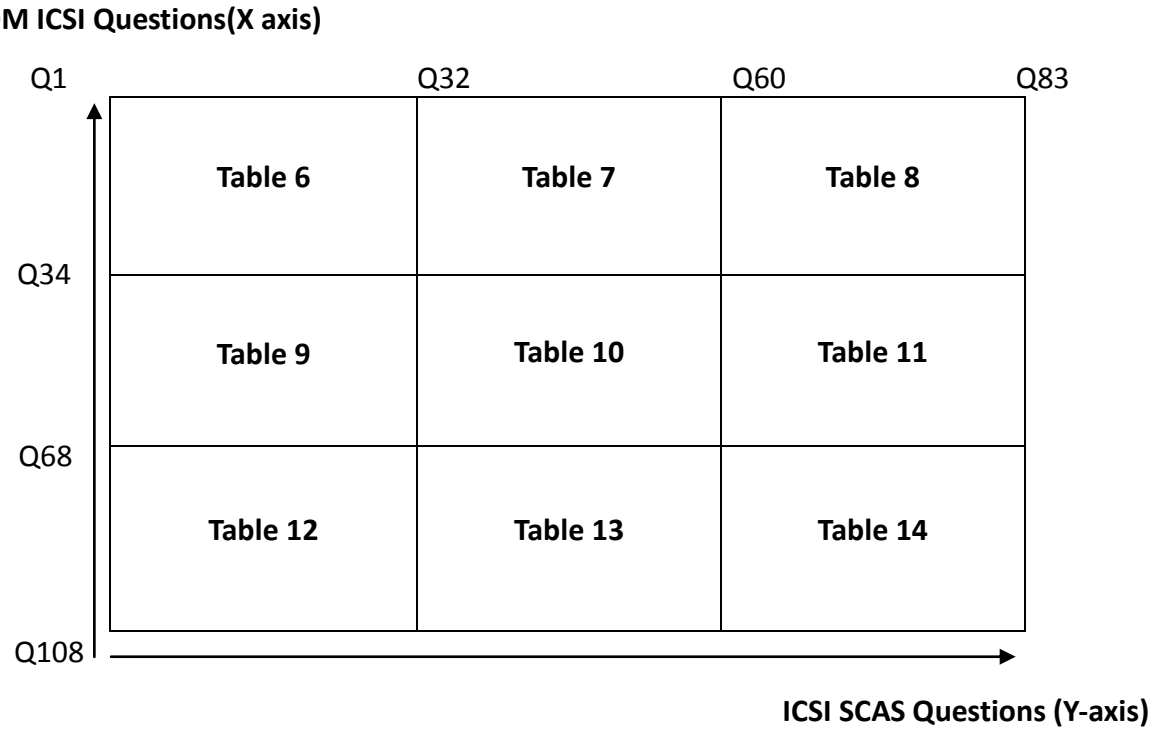


Figure 11: Overall Correlation Result Indication Diagram

変数名	Q_001	Q_003	Q_004	Q_007	Q_009	Q_013	Q_015	Q_018	Q_019	Q_020	Q_021	Q_022	Q_023	Q_029	Q_030	Q_031	Q_032
Q_001	0.233	0.236	0.253	0.301	0.231	0.238	0.197	0.182	0.264	0.273	0.243	0.168	0.246	0.198	0.26	0.323	0.269
Q_002	0.102	0.32	0.344	0.326	0.275	0.203	0.154	0.268	0.315	0.274	0.18	0.184	0.269	0.113	0.257	0.277	0.215
Q_003	0.178	0.406	0.357	0.44	0.243	0.238	0.195	0.214	0.272	0.223	0.198	0.168	0.221	0.143	0.284	0.317	0.244
Q_004	0.241	0.197	0.258	0.312	0.241	0.279	0.234	0.258	0.246	0.286	0.241	0.221	0.279	0.181	0.237	0.386	0.302
Q_005	0.133	0.585	0.459	0.455	0.213	0.204	0.205	0.206	0.239	0.196	0.184	0.186	0.191	0.156	0.259	0.283	0.15
Q_006	0.206	0.32	0.321	0.416	0.277	0.247	0.187	0.163	0.263	0.245	0.218	0.24	0.187	0.203	0.271	0.35	0.241
Q_007	0.139	0.321	0.301	0.386	0.236	0.161	0.177	0.247	0.298	0.218	0.193	0.197	0.228	0.152	0.251	0.323	0.221
Q_012	0.136	0.258	0.172	0.232	0.232	0.224	0.228	0.315	0.288	0.28	0.281	0.259	0.223	0.235	0.271	0.299	0.231
Q_013	0.164	0.228	0.253	0.302	0.268	0.231	0.247	0.282	0.308	0.277	0.19	0.261	0.22	0.156	0.235	0.246	0.227
Q_014	0.17	0.256	0.221	0.286	0.299	0.242	0.319	0.284	0.353	0.321	0.256	0.233	0.22	0.24	0.285	0.312	0.249
Q_015	0.137	0.243	0.209	0.244	0.21	0.201	0.221	0.236	0.272	0.21	0.196	0.247	0.261	0.188	0.191	0.244	0.261
Q_016	0.172	0.218	0.203	0.293	0.194	0.208	0.181	0.239	0.253	0.251	0.189	0.182	0.246	0.11	0.165	0.289	0.255
Q_017	0.336	0.218	0.277	0.315	0.23	0.289	0.284	0.254	0.333	0.311	0.316	0.237	0.231	0.326	0.278	0.359	0.31
Q_018R	0.23	0.227	0.247	0.292	0.214	0.202	0.19	0.254	0.324	0.263	0.255	0.185	0.211	0.335	0.292	0.318	0.263
Q_021	0.186	0.338	0.311	0.371	0.193	0.216	0.188	0.191	0.229	0.229	0.2	0.197	0.244	0.106	0.237	0.321	0.256
Q_022	0.143	0.262	0.273	0.285	0.231	0.176	0.193	0.201	0.227	0.234	0.211	0.204	0.22	0.131	0.264	0.322	0.223
Q_023	0.259	0.204	0.262	0.353	0.301	0.239	0.241	0.325	0.284	0.279	0.274	0.247	0.279	0.2	0.335	0.425	0.342
Q_024	0.236	0.246	0.289	0.275	0.261	0.267	0.267	0.303	0.35	0.325	0.334	0.272	0.244	0.302	0.297	0.31	0.309
Q_025	0.05	0.316	0.238	0.253	0.212	0.13	0.195	0.206	0.236	0.183	0.101	0.191	0.215	0.076	0.202	0.26	0.173
Q_028	0.164	0.199	0.259	0.293	0.259	0.219	0.191	0.271	0.249	0.263	0.251	0.209	0.296	0.176	0.218	0.287	0.294
Q_029	0.206	0.199	0.226	0.248	0.251	0.233	0.275	0.272	0.318	0.357	0.359	0.304	0.231	0.345	0.258	0.298	0.204
Q_030	0.227	0.222	0.204	0.251	0.279	0.255	0.291	0.289	0.36	0.348	0.313	0.26	0.236	0.312	0.268	0.291	0.191
Q_031	0.063	0.221	0.176	0.171	0.212	0.17	0.215	0.201	0.251	0.237	0.212	0.159	0.248	0.107	0.149	0.196	0.211
Q_032	0.103	0.244	0.198	0.228	0.219	0.263	0.334	0.268	0.274	0.253	0.233	0.227	0.272	0.203	0.262	0.26	0.238
Q_033	0.142	0.196	0.189	0.283	0.287	0.231	0.221	0.395	0.285	0.294	0.253	0.246	0.305	0.187	0.254	0.332	0.291
Q_034	0.19	0.237	0.204	0.26	0.334	0.296	0.285	0.347	0.327	0.281	0.289	0.273	0.269	0.202	0.234	0.316	0.269

Table 6: Correlation Analysis Value SDM SCAS Data Range (Q001-Q0034) (X axis) VS ICSI SCAS Data Range (Q001-Q032) (Y-axis)

変数名	Q_033	Q_034	Q_035	Q_036	Q_037	Q_038	Q_039	Q_040	Q_041	Q_042	Q_043	Q_046	Q_049	Q_051	Q_052	Q_059	Q_060
Q_001	0.281	0.209	0.221	0.278	0.286	0.227	0.222	0.254	0.284	0.273	0.262	0.24	0.314	0.211	0.228	0.303	0.246
Q_002	0.266	0.239	0.211	0.198	0.212	0.206	0.252	0.252	0.282	0.182	0.242	0.266	0.196	0.165	0.241	0.28	0.269
Q_003	0.296	0.227	0.289	0.244	0.237	0.298	0.251	0.307	0.32	0.278	0.3	0.235	0.244	0.24	0.231	0.289	0.329
Q_004	0.308	0.248	0.262	0.299	0.309	0.288	0.296	0.342	0.347	0.282	0.307	0.326	0.293	0.223	0.282	0.296	0.249
Q_005	0.269	0.22	0.288	0.246	0.259	0.252	0.235	0.258	0.261	0.291	0.263	0.199	0.239	0.187	0.205	0.283	0.301
Q_006	0.265	0.243	0.281	0.234	0.286	0.263	0.237	0.265	0.31	0.287	0.304	0.204	0.262	0.283	0.243	0.252	0.297
Q_007	0.258	0.277	0.297	0.255	0.209	0.254	0.348	0.334	0.305	0.269	0.318	0.233	0.242	0.232	0.258	0.302	0.243
Q_012	0.225	0.284	0.202	0.283	0.296	0.201	0.214	0.285	0.241	0.331	0.276	0.202	0.3	0.2	0.148	0.273	0.201
Q_013	0.243	0.27	0.167	0.275	0.301	0.194	0.254	0.261	0.256	0.275	0.282	0.223	0.257	0.218	0.223	0.325	0.247
Q_014	0.217	0.317	0.239	0.312	0.325	0.247	0.312	0.295	0.324	0.346	0.314	0.224	0.309	0.334	0.15	0.351	0.248
Q_015	0.22	0.256	0.218	0.183	0.23	0.242	0.241	0.263	0.25	0.294	0.306	0.282	0.251	0.193	0.181	0.313	0.275
Q_016	0.27	0.216	0.204	0.174	0.219	0.213	0.271	0.252	0.252	0.241	0.256	0.257	0.238	0.16	0.173	0.27	0.194
Q_017	0.236	0.271	0.22	0.258	0.335	0.266	0.265	0.308	0.336	0.367	0.294	0.248	0.345	0.224	0.18	0.293	0.222
Q_018R	0.228	0.277	0.286	0.26	0.299	0.324	0.224	0.286	0.309	0.312	0.328	0.188	0.287	0.323	0.16	0.298	0.295
Q_021	0.293	0.246	0.235	0.231	0.224	0.252	0.287	0.288	0.341	0.278	0.346	0.274	0.233	0.164	0.273	0.218	0.209
Q_022	0.259	0.234	0.167	0.225	0.251	0.181	0.221	0.252	0.3	0.221	0.274	0.207	0.252	0.13	0.214	0.231	0.174
Q_023	0.33	0.307	0.321	0.414	0.361	0.313	0.381	0.409	0.433	0.384	0.377	0.341	0.358	0.209	0.394	0.3	0.227
Q_024	0.244	0.291	0.311	0.36	0.408	0.274	0.308	0.383	0.356	0.348	0.336	0.28	0.367	0.285	0.251	0.369	0.303
Q_025	0.264	0.224	0.314	0.174	0.163	0.157	0.279	0.25	0.188	0.203	0.271	0.162	0.162	0.106	0.154	0.257	0.223
Q_028	0.27	0.208	0.199	0.233	0.279	0.201	0.28	0.295	0.336	0.244	0.289	0.232	0.241	0.133	0.246	0.294	0.245
Q_029	0.183	0.31	0.25	0.345	0.323	0.258	0.243	0.293	0.318	0.356	0.3	0.207	0.342	0.302	0.177	0.374	0.236
Q_030	0.181	0.246	0.282	0.295	0.331	0.243	0.235	0.253	0.266	0.35	0.255	0.168	0.342	0.277	0.143	0.326	0.265
Q_031	0.181	0.185	0.092	0.162	0.218	0.138	0.147	0.199	0.256	0.217	0.239	0.195	0.208	0.176	0.209	0.277	0.23
Q_032	0.187	0.274	0.213	0.242	0.292	0.265	0.139	0.249	0.257	0.311	0.292	0.235	0.296	0.201	0.158	0.29	0.192
Q_033	0.278	0.288	0.186	0.291	0.293	0.24	0.26	0.294	0.28	0.293	0.329	0.308	0.295	0.201	0.252	0.303	0.215
Q_034	0.206	0.251	0.238	0.291	0.288	0.205	0.27	0.328	0.283	0.317	0.332	0.263	0.361	0.229	0.23	0.348	0.175

Table 7: Correlation Analysis Value SDM SCAS Data Range (Q001-Q034) (X axis) VS ICSI SCAS Data Range (Q033-Q060) (Y-axis)

変数名	Q_061	Q_062	Q_063	Q_064	Q_065	Q_066	Q_067	Q_068	Q_071	Q_073	Q_074	Q_075	Q_076	Q_077	Q_078	Q_080	Q_082	Q_083
Q_001	0.217	0.157	0.193	0.218	0.198	0.289	0.212	0.253	0.262	0.247	0.266	0.295	0.278	0.322	0.256	0.294	0.264	0.209
Q_002	0.343	0.135	0.257	0.177	0.142	0.313	0.147	0.217	0.263	0.335	0.234	0.165	0.208	0.244	0.259	0.232	0.268	0.15
Q_003	0.248	0.179	0.252	0.272	0.217	0.338	0.212	0.15	0.247	0.293	0.231	0.179	0.221	0.272	0.215	0.228	0.25	0.24
Q_004	0.26	0.198	0.243	0.282	0.222	0.328	0.198	0.241	0.307	0.214	0.289	0.346	0.311	0.321	0.27	0.309	0.31	0.24
Q_005	0.233	0.191	0.277	0.258	0.22	0.376	0.227	0.19	0.268	0.304	0.223	0.18	0.218	0.26	0.234	0.217	0.258	0.215
Q_006	0.203	0.196	0.271	0.29	0.29	0.347	0.27	0.242	0.22	0.287	0.247	0.203	0.243	0.267	0.246	0.296	0.212	0.238
Q_007	0.243	0.173	0.254	0.264	0.244	0.306	0.21	0.207	0.264	0.261	0.233	0.222	0.262	0.273	0.231	0.316	0.207	0.219
Q_012	0.221	0.243	0.292	0.197	0.219	0.298	0.243	0.206	0.265	0.216	0.221	0.277	0.292	0.289	0.318	0.269	0.212	0.235
Q_013	0.281	0.204	0.266	0.243	0.19	0.357	0.225	0.252	0.271	0.257	0.232	0.21	0.217	0.28	0.318	0.281	0.317	0.197
Q_014	0.215	0.301	0.291	0.27	0.273	0.369	0.337	0.306	0.313	0.253	0.267	0.334	0.337	0.306	0.3	0.306	0.332	0.282
Q_015	0.241	0.211	0.257	0.242	0.233	0.331	0.262	0.237	0.247	0.402	0.258	0.249	0.237	0.307	0.294	0.245	0.236	0.201
Q_016	0.269	0.131	0.195	0.218	0.155	0.307	0.181	0.248	0.255	0.33	0.276	0.24	0.211	0.303	0.284	0.262	0.304	0.172
Q_017	0.236	0.286	0.272	0.245	0.277	0.318	0.311	0.289	0.266	0.375	0.316	0.306	0.283	0.372	0.31	0.304	0.259	0.232
Q_018R	0.18	0.274	0.286	0.269	0.277	0.381	0.323	0.249	0.296	0.3	0.262	0.264	0.261	0.269	0.287	0.254	0.268	0.254
Q_021	0.227	0.159	0.241	0.205	0.147	0.283	0.183	0.201	0.267	0.277	0.266	0.245	0.263	0.274	0.252	0.294	0.244	0.176
Q_022	0.216	0.135	0.226	0.15	0.186	0.285	0.227	0.259	0.259	0.284	0.193	0.166	0.19	0.232	0.242	0.201	0.219	0.163
Q_023	0.307	0.262	0.308	0.267	0.259	0.328	0.241	0.294	0.277	0.24	0.289	0.288	0.29	0.317	0.3	0.338	0.325	0.25
Q_024	0.269	0.301	0.32	0.284	0.309	0.354	0.33	0.233	0.283	0.279	0.279	0.348	0.318	0.344	0.337	0.31	0.28	0.286
Q_025	0.203	0.187	0.256	0.181	0.166	0.297	0.18	0.184	0.272	0.261	0.209	0.134	0.17	0.238	0.222	0.212	0.24	0.149
Q_028	0.279	0.217	0.225	0.208	0.194	0.271	0.172	0.214	0.24	0.292	0.308	0.277	0.248	0.306	0.253	0.299	0.265	0.178
Q_029	0.224	0.341	0.327	0.306	0.315	0.335	0.315	0.26	0.254	0.23	0.264	0.351	0.306	0.322	0.309	0.337	0.239	0.274
Q_030	0.228	0.335	0.293	0.267	0.306	0.342	0.327	0.256	0.277	0.252	0.238	0.32	0.281	0.324	0.329	0.312	0.238	0.247
Q_031	0.211	0.155	0.211	0.214	0.147	0.271	0.177	0.251	0.231	0.195	0.19	0.196	0.182	0.215	0.299	0.236	0.245	0.176
Q_032	0.192	0.259	0.24	0.215	0.163	0.321	0.232	0.313	0.295	0.227	0.296	0.305	0.299	0.312	0.329	0.33	0.271	0.242
Q_033	0.285	0.18	0.303	0.234	0.185	0.322	0.193	0.314	0.291	0.205	0.264	0.252	0.257	0.291	0.339	0.344	0.337	0.233
Q_034	0.232	0.252	0.286	0.227	0.23	0.366	0.218	0.304	0.311	0.279	0.285	0.345	0.274	0.311	0.315	0.324	0.33	0.31

Table 8: Correlation Analysis Value SDM SCAS Data Range (Q001-Q034) (X axis) VS ICSI SCAS Data Range (Q061-Q083) (Y-axis)

変数名	Q_001	Q_003	Q_004	Q_007	Q_009	Q_013	Q_015	Q_018	Q_019	Q_020	Q_021	Q_022	Q_023	Q_029	Q_030	Q_031	Q_032
Q_035	0.235	0.245	0.234	0.284	0.242	0.213	0.204	0.278	0.276	0.277	0.197	0.182	0.272	0.177	0.21	0.318	0.252
Q_039	0.218	0.183	0.248	0.376	0.325	0.263	0.249	0.283	0.284	0.337	0.259	0.281	0.287	0.178	0.23	0.341	0.292
Q_040R	0.209	0.204	0.255	0.283	0.278	0.246	0.261	0.235	0.274	0.252	0.244	0.243	0.242	0.31	0.257	0.33	0.288
Q_041	0.186	0.193	0.191	0.324	0.238	0.218	0.218	0.184	0.224	0.262	0.221	0.218	0.261	0.236	0.253	0.337	0.295
Q_042	0.258	0.276	0.256	0.363	0.228	0.211	0.168	0.216	0.228	0.233	0.212	0.202	0.283	0.133	0.284	0.413	0.262
Q_047	0.297	0.25	0.24	0.33	0.314	0.334	0.261	0.265	0.318	0.376	0.358	0.276	0.247	0.355	0.251	0.349	0.317
Q_048	0.192	0.176	0.157	0.217	0.25	0.248	0.213	0.241	0.268	0.313	0.293	0.255	0.197	0.305	0.257	0.303	0.274
Q_049R	0.228	0.219	0.216	0.289	0.291	0.269	0.222	0.239	0.31	0.297	0.306	0.221	0.198	0.265	0.254	0.265	0.233
Q_050	0.239	0.214	0.258	0.306	0.4	0.282	0.304	0.317	0.313	0.345	0.311	0.297	0.376	0.221	0.198	0.392	0.296
Q_051R	0.227	0.22	0.248	0.324	0.28	0.297	0.235	0.279	0.289	0.264	0.3	0.28	0.263	0.301	0.309	0.308	0.283
Q_052R	0.233	0.17	0.166	0.218	0.227	0.249	0.252	0.176	0.236	0.255	0.3	0.218	0.172	0.387	0.249	0.233	0.164
Q_053	0.176	0.205	0.226	0.249	0.24	0.215	0.302	0.304	0.371	0.333	0.372	0.311	0.222	0.325	0.272	0.295	0.235
Q_054	0.18	0.188	0.213	0.268	0.26	0.235	0.247	0.246	0.316	0.293	0.285	0.279	0.164	0.291	0.258	0.263	0.222
Q_055	0.11	0.203	0.163	0.196	0.176	0.23	0.249	0.278	0.284	0.296	0.272	0.267	0.177	0.248	0.26	0.262	0.195
Q_056	0.155	0.173	0.122	0.224	0.247	0.27	0.203	0.24	0.303	0.349	0.282	0.33	0.235	0.236	0.245	0.301	0.235
Q_057	0.284	0.192	0.22	0.312	0.3	0.285	0.318	0.272	0.261	0.325	0.325	0.207	0.25	0.332	0.271	0.352	0.235
Q_058	0.235	0.147	0.161	0.234	0.296	0.292	0.322	0.307	0.219	0.328	0.309	0.312	0.3	0.244	0.197	0.347	0.301
Q_059	0.36	0.169	0.224	0.26	0.243	0.253	0.175	0.237	0.303	0.306	0.276	0.189	0.196	0.288	0.234	0.333	0.214
Q_060	0.232	0.241	0.221	0.261	0.285	0.317	0.251	0.345	0.366	0.343	0.342	0.323	0.298	0.204	0.261	0.38	0.288
Q_061	0.324	0.231	0.237	0.315	0.284	0.312	0.306	0.293	0.317	0.317	0.347	0.309	0.267	0.302	0.273	0.369	0.307
Q_062	0.205	0.221	0.18	0.271	0.299	0.276	0.269	0.392	0.345	0.306	0.26	0.28	0.278	0.261	0.227	0.314	0.272
Q_063	0.286	0.356	0.278	0.4	0.218	0.305	0.245	0.175	0.254	0.258	0.261	0.248	0.2	0.254	0.287	0.384	0.244
Q_064	0.285	0.391	0.377	0.391	0.262	0.281	0.271	0.216	0.249	0.274	0.304	0.224	0.228	0.195	0.29	0.357	0.243
Q_065	0.273	0.214	0.224	0.248	0.207	0.266	0.184	0.306	0.232	0.28	0.287	0.254	0.317	0.168	0.161	0.309	0.252
Q_066	0.327	0.262	0.296	0.298	0.313	0.277	0.269	0.327	0.304	0.328	0.357	0.258	0.308	0.251	0.292	0.377	0.313
Q_067	0.149	0.269	0.267	0.323	0.272	0.231	0.223	0.229	0.286	0.272	0.257	0.213	0.253	0.219	0.259	0.317	0.211

Table 9: Correlation Analysis Value SDM SCAS Data Range (Q035-Q067) (X axis) VS ICSI SCAS Data Range (Q001-Q032) (Y-axis)

変数名	Q_033	Q_034	Q_035	Q_036	Q_037	Q_038	Q_039	Q_040	Q_041	Q_042	Q_043	Q_046	Q_049	Q_051	Q_052	Q_059	Q_060
Q_035	0.246	0.196	0.215	0.209	0.246	0.18	0.261	0.29	0.338	0.278	0.273	0.218	0.265	0.177	0.217	0.257	0.191
Q_039	0.315	0.265	0.25	0.264	0.253	0.243	0.29	0.317	0.328	0.323	0.385	0.304	0.279	0.243	0.274	0.285	0.285
Q_040R	0.268	0.267	0.296	0.318	0.302	0.291	0.238	0.329	0.378	0.308	0.324	0.245	0.279	0.331	0.266	0.308	0.381
Q_041	0.305	0.21	0.277	0.243	0.277	0.282	0.259	0.279	0.294	0.252	0.306	0.232	0.263	0.249	0.217	0.304	0.262
Q_042	0.339	0.267	0.288	0.329	0.244	0.25	0.308	0.318	0.384	0.303	0.306	0.276	0.246	0.217	0.32	0.237	0.237
Q_047	0.201	0.284	0.249	0.307	0.361	0.297	0.261	0.334	0.374	0.347	0.34	0.276	0.34	0.341	0.206	0.365	0.282
Q_048	0.182	0.237	0.195	0.286	0.312	0.245	0.258	0.294	0.262	0.307	0.268	0.221	0.315	0.269	0.155	0.295	0.213
Q_049R	0.237	0.277	0.25	0.272	0.31	0.349	0.21	0.266	0.303	0.298	0.281	0.214	0.288	0.341	0.218	0.34	0.321
Q_050	0.312	0.29	0.296	0.284	0.308	0.305	0.329	0.344	0.359	0.357	0.388	0.372	0.295	0.235	0.297	0.353	0.251
Q_051R	0.263	0.313	0.31	0.33	0.32	0.291	0.26	0.338	0.402	0.385	0.327	0.259	0.332	0.321	0.219	0.298	0.292
Q_052R	0.177	0.261	0.222	0.284	0.321	0.211	0.154	0.23	0.28	0.303	0.237	0.164	0.303	0.363	0.129	0.278	0.203
Q_053	0.224	0.312	0.294	0.344	0.352	0.268	0.25	0.309	0.283	0.38	0.323	0.204	0.371	0.326	0.151	0.342	0.211
Q_054	0.177	0.261	0.188	0.272	0.323	0.2	0.221	0.267	0.242	0.289	0.265	0.207	0.312	0.263	0.162	0.311	0.21
Q_055	0.16	0.302	0.172	0.285	0.304	0.226	0.158	0.232	0.201	0.325	0.262	0.184	0.293	0.243	0.107	0.299	0.163
Q_056	0.193	0.305	0.184	0.295	0.29	0.218	0.209	0.242	0.232	0.287	0.303	0.211	0.243	0.199	0.163	0.297	0.232
Q_057	0.223	0.252	0.248	0.313	0.369	0.283	0.237	0.273	0.385	0.345	0.326	0.251	0.329	0.33	0.23	0.305	0.217
Q_058	0.259	0.273	0.25	0.314	0.299	0.24	0.3	0.308	0.318	0.279	0.358	0.345	0.305	0.219	0.268	0.297	0.219
Q_059	0.202	0.241	0.202	0.254	0.313	0.266	0.264	0.303	0.337	0.308	0.308	0.243	0.304	0.267	0.218	0.294	0.255
Q_060	0.257	0.302	0.269	0.285	0.342	0.277	0.308	0.309	0.323	0.357	0.366	0.307	0.326	0.214	0.215	0.357	0.256
Q_061	0.25	0.322	0.237	0.353	0.425	0.253	0.302	0.374	0.35	0.405	0.344	0.295	0.38	0.295	0.211	0.308	0.26
Q_062	0.222	0.309	0.216	0.345	0.342	0.235	0.261	0.334	0.299	0.356	0.325	0.271	0.309	0.239	0.231	0.308	0.264
Q_063	0.275	0.279	0.307	0.314	0.338	0.269	0.304	0.359	0.369	0.369	0.285	0.211	0.317	0.334	0.25	0.276	0.29
Q_064	0.288	0.267	0.293	0.31	0.365	0.305	0.245	0.317	0.366	0.316	0.272	0.206	0.388	0.285	0.257	0.319	0.301
Q_065	0.236	0.235	0.162	0.284	0.242	0.211	0.253	0.232	0.309	0.268	0.247	0.274	0.284	0.171	0.252	0.219	0.142
Q_066	0.299	0.297	0.253	0.34	0.353	0.266	0.286	0.321	0.363	0.393	0.362	0.335	0.42	0.262	0.262	0.343	0.251
Q_067	0.225	0.232	0.223	0.207	0.298	0.265	0.247	0.246	0.299	0.272	0.298	0.22	0.263	0.229	0.232	0.289	0.245

Table 10: Correlation Analysis Value SDM SCAS Data Range (Q035-Q067) (X axis) VS ICSI SCAS Data Range (Q033-Q060) (Y-axis)

変数名	Q_061	Q_062	Q_063	Q_064	Q_065	Q_066	Q_067	Q_068	Q_071	Q_073	Q_074	Q_075	Q_076	Q_077	Q_078	Q_080	Q_082	Q_083
Q_035	0.204	0.199	0.241	0.229	0.227	0.282	0.202	0.229	0.247	0.278	0.286	0.273	0.261	0.302	0.229	0.288	0.31	0.226
Q_039	0.315	0.199	0.244	0.254	0.226	0.289	0.244	0.306	0.296	0.308	0.318	0.307	0.305	0.346	0.33	0.346	0.323	0.232
Q_040R	0.258	0.212	0.243	0.357	0.316	0.338	0.361	0.237	0.244	0.274	0.286	0.265	0.222	0.244	0.267	0.272	0.278	0.2
Q_041	0.286	0.214	0.229	0.27	0.276	0.331	0.269	0.35	0.289	0.319	0.319	0.255	0.276	0.306	0.33	0.296	0.287	0.278
Q_042	0.26	0.13	0.227	0.217	0.192	0.312	0.21	0.155	0.281	0.302	0.269	0.255	0.263	0.284	0.243	0.248	0.261	0.204
Q_047	0.253	0.286	0.319	0.328	0.321	0.365	0.321	0.329	0.281	0.316	0.391	0.396	0.379	0.401	0.302	0.318	0.335	0.328
Q_048	0.206	0.268	0.284	0.219	0.302	0.323	0.298	0.241	0.246	0.211	0.248	0.327	0.333	0.316	0.22	0.262	0.244	0.247
Q_049R	0.224	0.233	0.246	0.357	0.321	0.337	0.319	0.269	0.319	0.261	0.275	0.289	0.289	0.296	0.296	0.242	0.272	0.253
Q_050	0.296	0.246	0.288	0.244	0.229	0.337	0.257	0.297	0.328	0.31	0.318	0.323	0.308	0.348	0.326	0.367	0.346	0.286
Q_051R	0.278	0.254	0.271	0.281	0.298	0.363	0.301	0.245	0.301	0.254	0.289	0.324	0.306	0.319	0.311	0.313	0.295	0.24
Q_052R	0.191	0.248	0.238	0.298	0.343	0.292	0.359	0.205	0.222	0.183	0.24	0.324	0.286	0.314	0.188	0.257	0.204	0.221
Q_053	0.228	0.326	0.336	0.222	0.291	0.359	0.307	0.244	0.321	0.267	0.291	0.368	0.313	0.337	0.33	0.332	0.247	0.267
Q_054	0.18	0.267	0.307	0.25	0.267	0.32	0.25	0.255	0.26	0.276	0.233	0.306	0.276	0.264	0.276	0.288	0.232	0.271
Q_055	0.206	0.333	0.286	0.227	0.29	0.331	0.257	0.248	0.248	0.219	0.243	0.296	0.317	0.286	0.308	0.281	0.235	0.235
Q_056	0.245	0.274	0.278	0.201	0.231	0.315	0.23	0.257	0.295	0.242	0.26	0.348	0.286	0.291	0.289	0.284	0.29	0.233
Q_057	0.227	0.295	0.292	0.283	0.306	0.341	0.298	0.242	0.278	0.211	0.285	0.345	0.349	0.365	0.261	0.305	0.283	0.271
Q_058	0.281	0.219	0.223	0.265	0.244	0.295	0.263	0.269	0.283	0.21	0.296	0.334	0.312	0.354	0.3	0.332	0.315	0.256
Q_059	0.196	0.264	0.262	0.246	0.246	0.286	0.281	0.257	0.26	0.241	0.277	0.311	0.287	0.304	0.213	0.277	0.17	0.189
Q_060	0.332	0.312	0.318	0.308	0.253	0.37	0.266	0.343	0.374	0.291	0.32	0.347	0.356	0.369	0.402	0.363	0.376	0.279
Q_061	0.241	0.284	0.326	0.295	0.342	0.336	0.314	0.269	0.276	0.322	0.29	0.379	0.37	0.363	0.324	0.33	0.28	0.293
Q_062	0.281	0.289	0.316	0.246	0.261	0.387	0.278	0.304	0.364	0.291	0.297	0.357	0.355	0.379	0.398	0.349	0.323	0.282
Q_063	0.222	0.219	0.233	0.275	0.288	0.347	0.318	0.2	0.275	0.275	0.273	0.288	0.302	0.32	0.242	0.31	0.219	0.288
Q_064	0.228	0.211	0.225	0.306	0.313	0.355	0.307	0.269	0.291	0.298	0.261	0.279	0.312	0.327	0.241	0.242	0.237	0.287
Q_065	0.231	0.178	0.241	0.153	0.197	0.27	0.172	0.256	0.249	0.252	0.239	0.261	0.267	0.316	0.29	0.287	0.251	0.212
Q_066	0.226	0.264	0.264	0.238	0.263	0.362	0.276	0.317	0.368	0.305	0.327	0.299	0.334	0.375	0.33	0.298	0.352	0.246
Q_067	0.233	0.179	0.268	0.181	0.269	0.29	0.234	0.231	0.264	0.255	0.215	0.21	0.221	0.293	0.255	0.264	0.266	0.194

Table 11: Correlation Analysis Value SDM SCAS Data Range (Q035-Q067) (X axis) VS ICSI SCAS Data Range (Q061-Q083) (Y-axis)

変数名	Q_001	Q_003	Q_004	Q_007	Q_009	Q_013	Q_015	Q_018	Q_019	Q_020	Q_021	Q_022	Q_023	Q_029	Q_030	Q_031	Q_032
Q_068	0.213	0.382	0.309	0.415	0.3	0.243	0.26	0.318	0.332	0.307	0.296	0.298	0.315	0.145	0.307	0.439	0.314
Q_069	0.147	0.385	0.281	0.394	0.283	0.211	0.213	0.273	0.293	0.276	0.223	0.288	0.261	0.138	0.316	0.426	0.236
Q_070R	0.052	0.12	0.148	0.139	0.084	0.142	0.1	0.112	0.117	0.063	0.091	0.044	0.205	0.109	0.12	0.198	0.159
Q_071	0.255	0.298	0.272	0.339	0.33	0.294	0.265	0.301	0.406	0.36	0.331	0.298	0.343	0.259	0.275	0.356	0.297
Q_073	0.169	0.276	0.249	0.264	0.279	0.23	0.232	0.218	0.235	0.241	0.288	0.254	0.201	0.223	0.258	0.271	0.202
Q_075	0.13	0.247	0.207	0.23	0.295	0.208	0.246	0.247	0.346	0.298	0.296	0.338	0.202	0.266	0.305	0.298	0.217
Q_079	0.3	0.254	0.216	0.352	0.226	0.269	0.243	0.206	0.329	0.293	0.252	0.263	0.196	0.177	0.292	0.39	0.278
Q_080	0.214	0.211	0.243	0.32	0.24	0.21	0.166	0.243	0.256	0.241	0.199	0.211	0.298	0.048	0.152	0.331	0.332
Q_081	0.148	0.22	0.159	0.261	0.202	0.176	0.158	0.141	0.273	0.213	0.179	0.19	0.118	0.151	0.199	0.214	0.181
Q_082	0.193	0.274	0.179	0.239	0.314	0.247	0.29	0.269	0.377	0.321	0.3	0.316	0.227	0.301	0.278	0.31	0.244
Q_083	0.15	0.257	0.183	0.293	0.32	0.229	0.275	0.212	0.29	0.274	0.212	0.249	0.269	0.194	0.208	0.297	0.259
Q_096	0.159	0.295	0.367	0.398	0.287	0.268	0.246	0.278	0.308	0.323	0.237	0.243	0.263	0.198	0.268	0.375	0.338
Q_097	0.207	0.242	0.279	0.314	0.339	0.335	0.322	0.374	0.333	0.31	0.313	0.28	0.341	0.259	0.291	0.366	0.376
Q_098	0.308	0.261	0.266	0.334	0.4	0.396	0.396	0.339	0.348	0.344	0.409	0.332	0.279	0.365	0.404	0.416	0.349
Q_099	0.291	0.262	0.282	0.371	0.41	0.41	0.388	0.34	0.384	0.349	0.419	0.333	0.343	0.349	0.379	0.437	0.359
Q_100	0.268	0.261	0.277	0.34	0.33	0.351	0.354	0.336	0.363	0.338	0.362	0.274	0.316	0.312	0.334	0.404	0.318
Q_101	0.248	0.22	0.227	0.305	0.343	0.349	0.31	0.372	0.32	0.289	0.331	0.255	0.312	0.267	0.3	0.352	0.315
Q_102	0.292	0.164	0.232	0.345	0.31	0.383	0.302	0.322	0.317	0.344	0.352	0.235	0.335	0.276	0.284	0.381	0.409
Q_103	0.295	0.213	0.255	0.353	0.282	0.331	0.245	0.325	0.269	0.317	0.329	0.224	0.369	0.216	0.304	0.403	0.402
Q_105	0.471	0.191	0.249	0.311	0.283	0.382	0.295	0.247	0.316	0.339	0.382	0.269	0.241	0.348	0.273	0.389	0.361
Q_104	0.274	0.21	0.281	0.374	0.242	0.282	0.209	0.185	0.22	0.253	0.189	0.14	0.234	0.185	0.262	0.366	0.27
Q_106	0.311	0.221	0.252	0.291	0.232	0.307	0.219	0.284	0.228	0.286	0.286	0.21	0.354	0.259	0.242	0.387	0.377
Q_107	0.218	0.204	0.153	0.238	0.252	0.257	0.221	0.22	0.277	0.265	0.329	0.264	0.143	0.336	0.279	0.315	0.224
Q_108	0.352	0.27	0.306	0.37	0.227	0.305	0.148	0.25	0.258	0.311	0.293	0.22	0.28	0.251	0.27	0.393	0.275

Table 12: Correlation Analysis Value SDM SCAS Data Range (Q068-Q108) (X axis) VS ICSI SCAS Data Range (Q001-Q032) (Y-axis)

変数名	Q_033	Q_034	Q_035	Q_036	Q_037	Q_038	Q_039	Q_040	Q_041	Q_042	Q_043	Q_046	Q_049	Q_051	Q_052	Q_059	Q_060
Q_068	0.323	0.401	0.386	0.344	0.3	0.284	0.324	0.378	0.391	0.401	0.416	0.28	0.314	0.279	0.269	0.304	0.287
Q_069	0.266	0.4	0.427	0.345	0.306	0.328	0.341	0.365	0.344	0.393	0.4	0.264	0.303	0.262	0.234	0.298	0.306
Q_070R	0.236	0.094	0.181	0.115	0.163	0.209	0.13	0.135	0.172	0.137	0.183	0.102	0.14	0.119	0.154	0.151	0.207
Q_071	0.289	0.323	0.268	0.319	0.318	0.295	0.379	0.406	0.392	0.311	0.383	0.281	0.324	0.27	0.255	0.363	0.316
Q_073	0.188	0.31	0.232	0.295	0.321	0.273	0.187	0.272	0.297	0.304	0.291	0.195	0.322	0.216	0.118	0.309	0.215
Q_075	0.214	0.269	0.242	0.289	0.336	0.266	0.238	0.312	0.273	0.303	0.324	0.152	0.31	0.236	0.14	0.341	0.248
Q_079	0.275	0.266	0.246	0.312	0.293	0.266	0.271	0.274	0.293	0.31	0.287	0.226	0.309	0.217	0.235	0.27	0.258
Q_080	0.34	0.194	0.188	0.26	0.223	0.266	0.306	0.255	0.332	0.25	0.302	0.241	0.212	0.102	0.27	0.23	0.195
Q_081	0.212	0.176	0.164	0.176	0.211	0.266	0.22	0.231	0.209	0.169	0.204	0.144	0.164	0.109	0.116	0.242	0.189
Q_082	0.221	0.283	0.25	0.307	0.348	0.266	0.233	0.304	0.281	0.336	0.359	0.184	0.285	0.252	0.105	0.379	0.295
Q_083	0.266	0.21	0.187	0.219	0.245	0.266	0.263	0.276	0.288	0.26	0.331	0.235	0.182	0.16	0.18	0.313	0.262
Q_096	0.361	0.273	0.271	0.247	0.299	0.266	0.303	0.337	0.4	0.286	0.371	0.291	0.271	0.205	0.334	0.314	0.255
Q_097	0.324	0.296	0.221	0.337	0.382	0.266	0.274	0.32	0.377	0.381	0.38	0.352	0.356	0.245	0.286	0.319	0.243
Q_098	0.346	0.346	0.321	0.436	0.551	0.266	0.316	0.409	0.407	0.457	0.403	0.319	0.503	0.4	0.276	0.433	0.327
Q_099	0.368	0.352	0.335	0.419	0.478	0.266	0.364	0.446	0.445	0.462	0.453	0.347	0.48	0.376	0.312	0.447	0.354
Q_100	0.331	0.314	0.267	0.361	0.387	0.266	0.296	0.407	0.391	0.412	0.461	0.322	0.399	0.313	0.227	0.419	0.309
Q_101	0.299	0.309	0.245	0.367	0.391	0.266	0.309	0.346	0.345	0.38	0.361	0.302	0.365	0.275	0.255	0.354	0.269
Q_102	0.336	0.3	0.24	0.261	0.404	0.266	0.331	0.347	0.448	0.397	0.387	0.422	0.409	0.287	0.423	0.333	0.222
Q_103	0.355	0.337	0.248	0.282	0.369	0.266	0.366	0.344	0.473	0.382	0.408	0.381	0.384	0.225	0.496	0.306	0.198
Q_105	0.27	0.286	0.222	0.332	0.411	0.266	0.305	0.347	0.409	0.385	0.314	0.312	0.425	0.322	0.327	0.298	0.241
Q_104	0.337	0.238	0.305	0.217	0.245	0.266	0.346	0.322	0.41	0.311	0.337	0.27	0.23	0.206	0.334	0.25	0.245
Q_106	0.299	0.245	0.22	0.284	0.314	0.266	0.335	0.334	0.401	0.285	0.326	0.332	0.304	0.222	0.38	0.26	0.234
Q_107	0.15	0.283	0.249	0.307	0.385	0.266	0.234	0.248	0.253	0.4	0.247	0.206	0.362	0.352	0.138	0.326	0.25
Q_108	0.297	0.253	0.285	0.302	0.275	0.266	0.293	0.331	0.396	0.367	0.331	0.276	0.299	0.288	0.259	0.284	0.273

Table 13: Correlation Analysis Value SDM SCAS Data Range (Q068-Q108) (X axis) VS ICSI SCAS Data Range (Q033-Q060) (Y-axis)

変数名	Q_061	Q_062	Q_063	Q_064	Q_065	Q_066	Q_067	Q_068	Q_071	Q_073	Q_074	Q_075	Q_076	Q_077	Q_078	Q_080	Q_082	Q_083
Q_068	0.283	0.212	0.292	0.246	0.26	0.367	0.287	0.255	0.355	0.382	0.316	0.296	0.26	0.333	0.337	0.357	0.324	0.231
Q_069	0.291	0.247	0.291	0.248	0.229	0.357	0.281	0.194	0.358	0.291	0.249	0.276	0.253	0.308	0.326	0.325	0.272	0.214
Q_070R	0.133	0.12	0.1	0.207	0.179	0.186	0.131	0.121	0.129	0.175	0.108	0.094	0.13	0.115	0.188	0.12	0.099	0.087
Q_071	0.365	0.262	0.341	0.265	0.286	0.362	0.291	0.305	0.375	0.33	0.357	0.325	0.343	0.406	0.336	0.345	0.367	0.251
Q_073	0.202	0.262	0.268	0.231	0.257	0.342	0.288	0.22	0.264	0.253	0.237	0.273	0.275	0.255	0.249	0.227	0.221	0.236
Q_075	0.252	0.283	0.356	0.271	0.287	0.379	0.281	0.23	0.313	0.282	0.268	0.309	0.299	0.26	0.223	0.237	0.209	0.278
Q_079	0.267	0.173	0.249	0.278	0.243	0.341	0.282	0.302	0.313	0.28	0.313	0.297	0.3	0.336	0.32	0.294	0.261	0.245
Q_080	0.289	0.123	0.153	0.192	0.124	0.266	0.116	0.239	0.254	0.337	0.304	0.247	0.221	0.323	0.325	0.265	0.319	0.178
Q_081	0.215	0.14	0.155	0.22	0.217	0.257	0.168	0.238	0.234	0.259	0.226	0.163	0.158	0.172	0.193	0.149	0.094	0.076
Q_082	0.241	0.369	0.341	0.311	0.307	0.416	0.357	0.341	0.392	0.339	0.334	0.373	0.372	0.314	0.292	0.288	0.267	0.283
Q_083	0.303	0.221	0.242	0.269	0.185	0.357	0.179	0.304	0.314	0.331	0.293	0.292	0.312	0.315	0.305	0.262	0.328	0.235
Q_096	0.279	0.19	0.245	0.275	0.231	0.348	0.212	0.272	0.33	0.343	0.341	0.286	0.275	0.316	0.297	0.343	0.301	0.207
Q_097	0.252	0.265	0.279	0.245	0.284	0.404	0.237	0.289	0.359	0.294	0.308	0.304	0.318	0.353	0.393	0.319	0.37	0.265
Q_098	0.247	0.385	0.365	0.356	0.443	0.457	0.444	0.371	0.33	0.31	0.352	0.439	0.418	0.414	0.36	0.369	0.327	0.357
Q_099	0.333	0.356	0.347	0.408	0.42	0.496	0.407	0.406	0.431	0.35	0.421	0.51	0.482	0.448	0.415	0.406	0.434	0.369
Q_100	0.306	0.338	0.343	0.32	0.306	0.412	0.334	0.378	0.382	0.344	0.383	0.392	0.393	0.386	0.361	0.348	0.363	0.295
Q_101	0.286	0.332	0.284	0.272	0.281	0.368	0.317	0.345	0.362	0.289	0.298	0.398	0.344	0.402	0.385	0.327	0.333	0.315
Q_102	0.315	0.245	0.237	0.3	0.249	0.351	0.296	0.37	0.326	0.287	0.343	0.377	0.398	0.419	0.33	0.358	0.343	0.352
Q_103	0.292	0.229	0.243	0.252	0.201	0.32	0.251	0.316	0.34	0.334	0.344	0.343	0.311	0.381	0.316	0.361	0.339	0.301
Q_105	0.25	0.294	0.252	0.318	0.316	0.349	0.312	0.309	0.258	0.294	0.331	0.439	0.416	0.432	0.299	0.305	0.286	0.305
Q_104	0.282	0.179	0.192	0.212	0.22	0.25	0.201	0.241	0.226	0.315	0.29	0.181	0.236	0.301	0.244	0.289	0.235	0.134
Q_106	0.244	0.185	0.21	0.311	0.235	0.299	0.244	0.334	0.282	0.293	0.378	0.342	0.307	0.377	0.264	0.33	0.338	0.234
Q_107	0.179	0.392	0.306	0.255	0.339	0.342	0.351	0.244	0.243	0.215	0.186	0.355	0.312	0.297	0.214	0.244	0.199	0.268
Q_108	0.259	0.19	0.193	0.294	0.252	0.321	0.242	0.252	0.315	0.269	0.287	0.285	0.313	0.349	0.276	0.326	0.319	0.283

Table 14: Correlation Analysis Value SDM SCAS Data Range (Q068-Q108) (X axis) VS ICSI SCAS Data Range (Q061-Q083) (Y-axis)

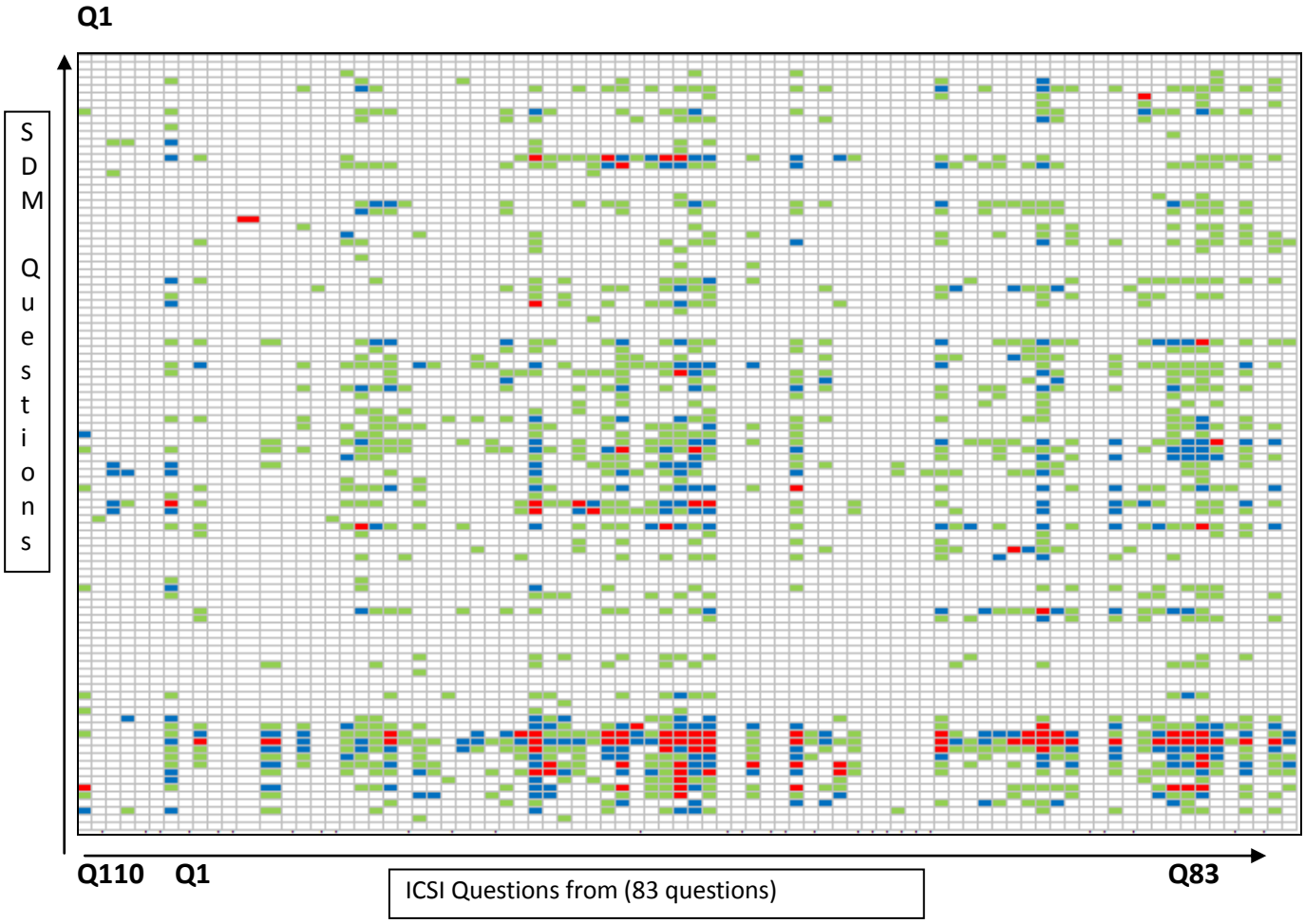


Figure 12: Correlation Analysis between SDM SCAS Questionnaires with ICSI SCAS Questionnaires

	strong relation	above 0.4
	Relation	btw 0.35 to 0.4
	weak relation	btw 0.3 to 0.35
	no relation	0.3 and below

4.5 Introduction about SCAS Model Structure

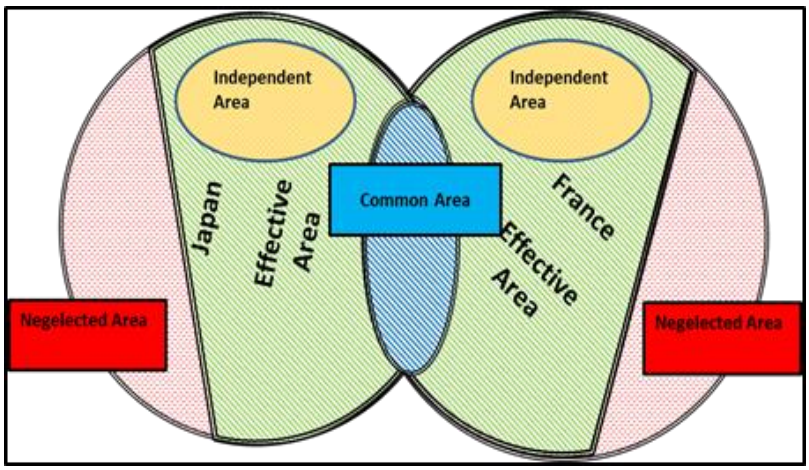


Figure 13: SCAS Model Structure

1. **Common Area (Blue colour part)**

   => Candidate questions that have common safety concept between Japan and France

2. **Neglected Area (red colour part)**

   => Candidate questions that are ineffective on safety culture assessment system

3. **Independent Area (yellow colour part)**

   => Potential questions for innovative of safety culture.

   => Candidate questions that could be new ideas introduce to either SDM or ICSI SCAS

4. **Effective Area (Green part)**

   => Candidate questions are effective to assess on France SCAS and Japan SCAS

   => Candidate questions to integration as core questions to become SCAS questionnaires to assess safety level of one company

In Common Areas that have analysis into three ways as below:

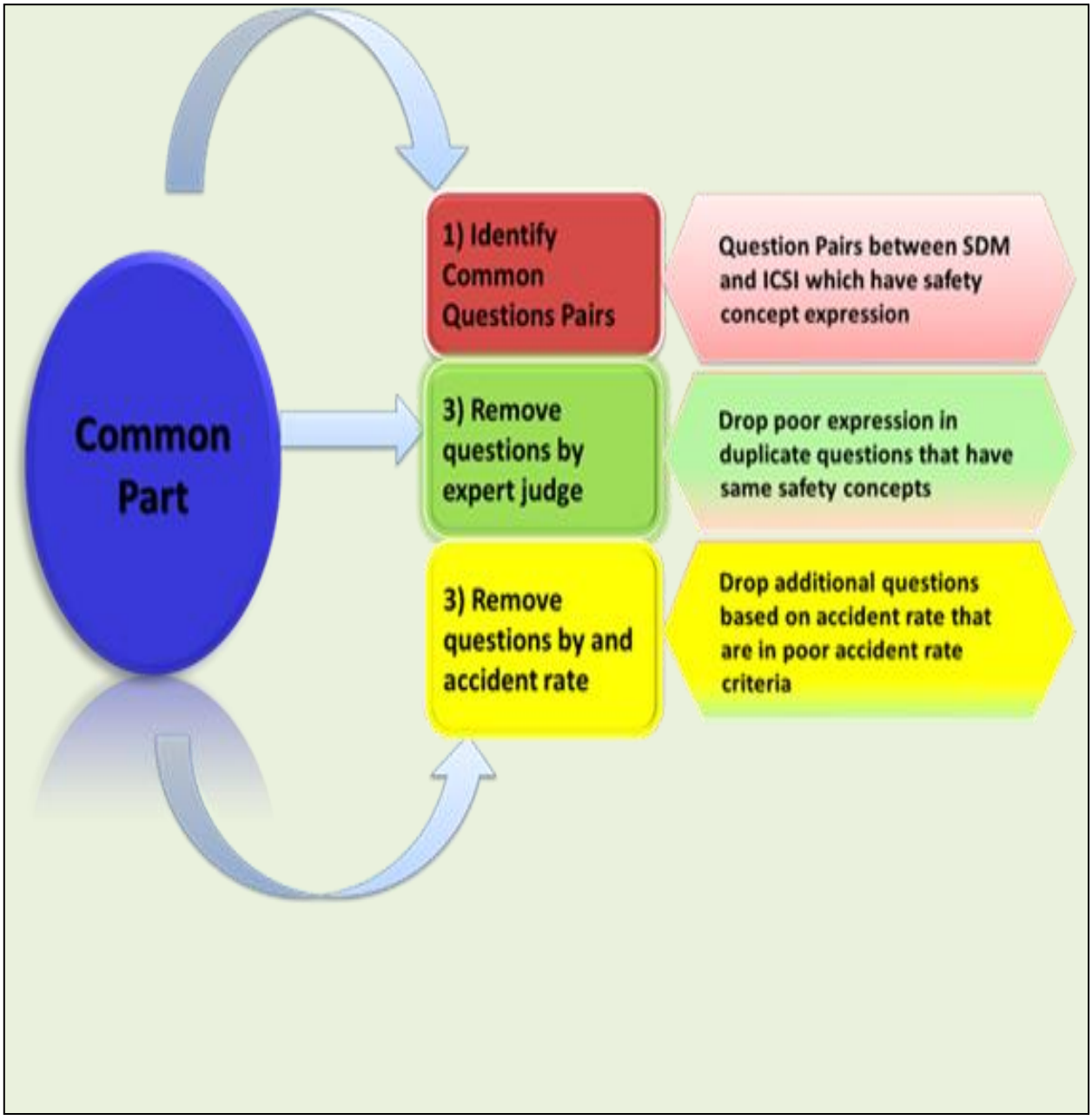


Figure 14: Analysis Type of Common Questions between Japan and France

4.6 List of Type of Common Questions between Japan and France

No	SDM SCAS Questions	Axis	No	ICSI SCAS Questions	Group
Q_004	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	7.Communication	Q_160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	5.Behavioural safety management
Q_005	Interpersonal relations between employees are good at this worksite.	7.Communication	Q_132	Interpersonal relations and communications between employees are good at this worksite	1.Organization and work content
Q_012	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	5.Learning	Q_147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	3.Technical safety management
Q_031	Good housekeeping / storage and work area organization is in place.	6.Awareness	Q_141R	Housekeeping and storage is poor on this worksite.	7.Employees behaviour
Q_046R	Equipment and installation were used passed their service life.	8.Work Management	Q145R	It may happen that installations are operated in a downgraded situation.	3.Technical safety management
Q_049	Work habits take priority over rules and regulations.	2.Commitment	Q_196R	Some written safety rules applicable to routine tasks are bypassed by employees	7.Employees behaviour
Q_050	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	2.Commitment	Q_183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	5.Behavioural safety management
Q_057	The environmental conditions of the work area are in accordance with regulated occupational health standards.	6.Awareness	Q_153	The HSE MS is effective for controlling risks of occupational illnesses.	3.Technical safety management
Q_077	I am often recognized and acknowledged for good accomplishments and prioritizing safety	4.Motivation	Q_182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	5.Behavioural safety management
Q_084	There are opportunities for us to bypass safety rules under time pressure or non essential rules.	8.Work Management	Q_193	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	7.Employees behaviour
Q_085R	I believe that professionals are able to perform even dangerous work.	8.Work Management	Q210R	Employees are overconfident in their own abilities.	7.Employees behaviour
Q_088	In case of concern or safety issues, budget are always available.	1.Governance	Q_162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	2.Management leadership
Q_096	Coordination, collaboration and communication between departments are good.	7.Communication	Q_133	Interpersonal relations and communications between departments and trades are good at this worksite.	1.Organization and work content
Q-098	Top management communicates and show that they puts a high priority on safety.	1.Governance	Q_166	Top management puts a very high priority on safety at work.	2.Management leadership

Table 15: List of Common Question Pairs that are having Same Safety Concept Meaning between SDM and ICSI

No	SDM SCAS Questions	Axis
Q_014	Rules and procedures are properly revised, understood and used .	5.Learning
Q_020	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	1.Governance
Q_029	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	6.Awareness
Q_044	Employee could be blamed after an incident caused by personal error or mistake.	6.Awareness
Q_053	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	6.Awareness
Q_056	Lockout / tag out procedures are used during work, and permission is granted by the shift supervisor.	6.Awareness
Q_058	There is a system in place to report, handle and revise non-compliance situation.	6.Awareness
Q_060	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	6.Awareness
Q_074	I take priority to finish a task quickly rather than completing task using a safe and reliable method.	8.Work Management
Q_082	I always use standard operation procedures and checklists.	8.Work Management
Q_099	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	1.Governance
Q_103	Management communicate directly with employees about safety actions.	2.Commitment

Table 16: List of SDM Candidate Common Questions that are Integrated or Good Expression in Duplicate Questions.

No	ICSI SCAS Questions	Group
Q_170	Top management has credibility regarding safety at work because they practice what they preach.	2.Management leadership
Q_173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	5.Behavioural safety management
Q_201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	7.Employees behaviour

Table 17: List of ICSI Candidate Common Questions that are Integrated or Good Expression in Duplicate Questions.

4.7 List of SDM SCAS Questionnaires into SCAS Model Structure

From the correlation result of semantic and spearman analysis result, list of SDM Safety Culture Assessment System (SCAS) questionnaires able to be grouped into SCAS model structure.

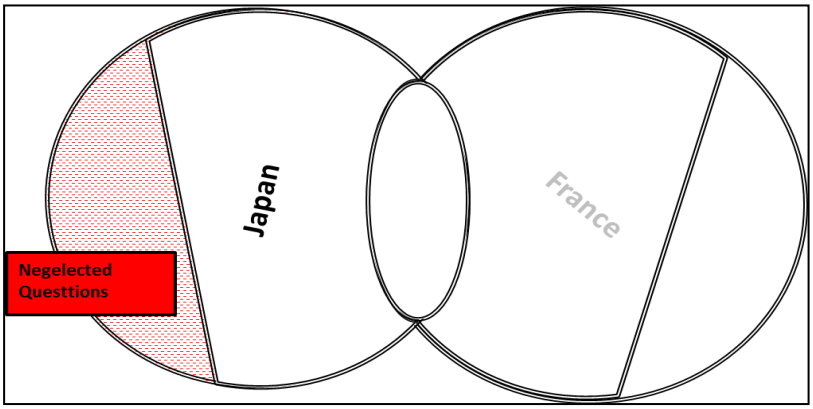


Figure 15: SDM Neglected Questions in SCAS Model Structure

		SDM neglected question list	Axis
1	Q_002	Teammates are highly motivated to work together focused on improvement.	4.Motivation
2	Q_003	I do not hesitate to communicate about my concerns and request with colleague.	7.Communication
3	Q_006	Employees are able to freely express their opinion regardless of their position or experience.	7.Communication
4	Q_008R	Some departments or individuals use too much overtimes to perform their jobs.	3.Resource Management
5	Q_015	In order to improve operational skills, one-on-one guidance is given by experienced co-workers.	5.Learning
6	Q_019	Employees are open to changes and modification of organization and system.	1.Governance
7	Q_022	Employees always work hard for continuous improvement.	4.Motivation
8	Q_023	Management participates in safety education and training with constructive manner.	2.Commitment
9	Q_024	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	7.Communication
10	Q_025	People collaborate to help each other when work is unbalance between departments or employees.	7.Communication
11	Q_026R	There are too many useless or inefficient meetings.	3.Resource Management
12	Q_027	There is an age imbalance in the composition of the employees and the transition of technical skills cannot be completed smoothly.	3.Resource Management
13	Q_032	Hazardous areas and operational hazards are properly labelled to make people aware.	6.Awareness

14	Q_033	Best safety measures and practices from other plants/other companies are introduced and implemented.	5.Learning
15	Q_038	Safety initiatives are shared with entire workforce, and excellent actions are acknowledged.	2.Commitment
16	Q_041	Managers and employees try to reduce amount of work by revising or streamlining work and procedures.	3.Resource Management
17	Q_043	Job evaluation by management takes in consideration both positive and negative.	3.Resource Management
18	Q_059	Process risk assessment method as HAZOP is used to assess risk of equipment / installations.	8.Work Management
19	Q_070R	There are many unnecessary routine tasks that were not originally part of my responsibilities.	3.Resource Management
20	Q_071	Safety training and education are useful and efficient.	5.Learning
21	Q_072	Necessary manuals / diagrams / information are easily accessible.	8.Work Management
22	Q_073	I immediately take action to solve unclear situation during daily work.	8.Work Management
23	Q_075	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	8.Work Management
24	Q_078	I actively participate in small group activities within my workplace.	2.Commitment
25	Q_079	I actively share beneficial information with everyone.	7.Communication
26	Q_083	Standard operation procedures are well designed and easy to use.	8.Work Management
27	Q_086	All decision makes to satisfy company needs.	1.Governance
28	Q_087R	Decisions made by the management always right.	7.Communication
29	Q_089R	Issue related to on-site safety solved by each department and not reported to HSE department.	1.Governance
30	Q_090	Talented people are promoted in the HSE department.	1.Governance
31	Q_092R	Important operational tasks are outsourced to sub-contractors.	1.Governance
32	Q_094	Employee can apply for new job or position through in-house staff recruitment system.	4.Motivation
33	Q_101	Safety performance (number of accidents/safety actions/safety budget) is communicated with workforce and used to revise next year plan.	1.Governance
34	Q_104	The salary structure corresponds to the quality and quantity of work.	3.Resource Management
35	Q_110R	Downsizing or personnel job reduction have occurred at your company.	3.Resource Management

Table 18: List of SDM Neglected Questions

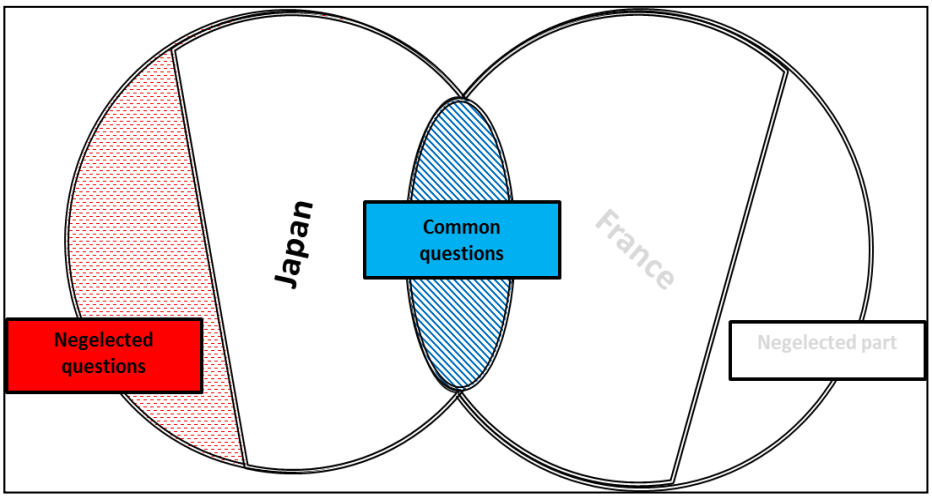


Figure 16:SDM Common Questions in SCAS Model Structure

		SDM Common Question List	Axis
1	Q_004	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	7.Communication
2	Q_005	Interpersonal relations between employees are good at this worksite.	7.Communication
3	Q_012	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	5.Learning
4	Q_014	Rules and procedures are properly revised, understood and used.	5.Learning
5	Q_020	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	1.Governance
6	Q_029	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	6.Awareness
7	Q_031	Good housekeeping / storage and work area organization is in place.	6.Awareness
8	Q_044	Employee could be blamed after an incident caused by personal error or mistake.	6.Awareness
9	Q_046R	Equipment and installation were used passed their service life.	2.Commitment
10	Q_049	Work habits take priority over rules and regulations.	1.Governance
11	Q_050	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	2.Commitment
12	Q_053	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	6.Awareness
13	Q_056	Lockout / tag out procedures are used during work, and permission is granted by the shift supervisor.	6.Awareness
14	Q_057	The environmental conditions of the work area are in accordance with regulated occupational health standards.	6.Awareness
15	Q_058	There is a system in place to report, handle and revise non-compliance situation.	6.Awareness
16	Q_060	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	6.Awareness

17	Q_074	I take priority to finish a task quickly rather than completing task using a safe and reliable method.	8.Work Management
18	Q_077	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	4.Motivation
19	Q_082	I always use standard operation procedures and checklists.	8.Work Management
20	Q_084R	There are opportunities for us to bypass safety rules under time pressure or non-essential rules.	8.Work Management
21	Q_085R	I believe that professionals are able to perform even dangerous work.	8.Work Management
22	Q_088	In case of concern or safety issues, budgets are always available.	1.Governance
23	Q_096	Coordination, collaboration and communication between departments are good.	7.Communication
24	Q_098	Top management communicates and show that they put a high priority on safety.	1.Governance
25	Q_099	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	1.Governance
26	Q_103	Management communicate directly with employees about safety actions.	2.Commitment

Table 19: List of Common Questions

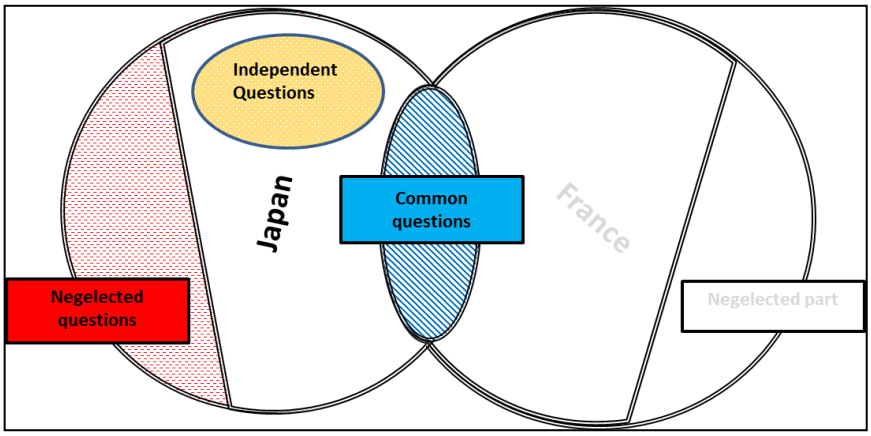


Figure 17: SDM Independent in SCAS Model Structure

		SDM Independent Question List	Axis
1	Q_001	The company makes consideration to create a pleasant work atmosphere for sub-contacting employees.	4.Motivation
2	Q_009	Sub-contractor employees receive sufficient training on the safety.	3.Resource Management
3	Q_010	The sub-contracting company is implementing its own safety activities.	3.Resource Management
4	Q_011	There are some formal and informal events that company and sub-contracting company employees can attend.	3.Resource Management
5	Q_016	Important technical skills must be listed, and program is in place to transmit this information without any omissions.	5.Learning
6	Q_028	Technical information is shared between maintenance department and operations department.	3.Resource Management
7	Q_035	There are systematic skills training programs available which people can attend based on their skill level.	5.Learning
8	Q_036	Good conditions of equipment (such as the pumps) are continually inspected, and any abnormalities are reported.	8.Work Management
9	Q_037	Initiative and attitudes for safety actions are promoted and included in the personnel evaluations.	2.Commitment
10	Q_045	The labelling, colour code, signs and hazard limits are consistent.	6.Awareness
11	Q_048	When implementing change, permission by expert supervisor is required.	8.Work Management
12	Q_054	There are systematic symbols/numbers labelled on the important components, such as valves/plumbing/pumps, it coincides with the P&ID.	6.Awareness
13	Q_055	The important valves are labelled with tags (Open/ close/ do not operate).	6.Awareness
14	Q_065	Participating in symposiums/conventions/seminars related to safety is encouraged.	2.Commitment
15	Q_067	I trust the sub-contractors technical competency.	7.Communication
16	Q_076	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	1.Governance
17	Q_080	There is a systematic training program to improve expertise on specific installation.	3.Resource Management
18	Q_081	I often visit on-site to find anomalies in equipment.	8.Work Management
19	Q_091	Our company has a system to develop HSE specialists.	1.Governance

Table 20: List of SDM independent questions

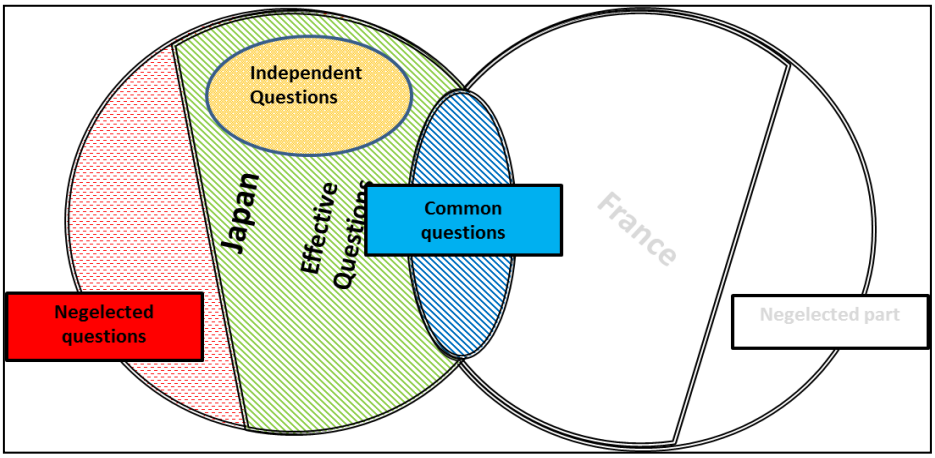


Figure 18: SDM Effective Questions in SCAS Model Structure

		SDM Effective Questionnaires	Axis
1	Q_007	Supervisors / managers have good understanding of their employee's jobs / responsibilities / progress.	7.Communication
2	Q_013	During On the Job Training, safety is highly emphasized as very important.	5.Learning
3	Q_017	For planning maintenance shutdown, previous accomplishments are considered.	8.Work Management
4	Q_018R	Role and responsibilities are ambiguous within the workplace.	1.Governance
5	Q_021	During discussion with management, employees have clear understanding of personnel evaluation and goals.	4.Motivation
6	Q_030	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	6.Awareness
7	Q_034	Experience related to past accidents, incidents and human behaviours are taken in consideration in work standards and procedures.	5.Learning
8	Q_039	Any concerns and/or requests from the sub-contractors are reported to the company management and are promptly taken care of.	7.Communication
9	Q_040	Non real information and rumours are incorrectly reported.	7.Communication
10	Q_042	Managements and supervisors take serious consideration about your job and your future.	3.Resource Management
11	Q_047	Management of change for equipment and procedures are clearly defined and implemented.	8.Work Management
12	Q_051R	In case of new installation or maintenance, review procedures are insufficiently organized.	2.Commitment
13	Q_052R	Equipment is operated systematically above normal design conditions.	3.Resource Management
14	Q_061	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	6.Awareness
15	Q_062	Accident and incidents records are organized in database and used for daily safety activities or training	6.Awareness
16	Q_063	My supervisor/management trusts my technical strengths/abilities.	4.Motivation
17	Q_064	I get satisfaction from my job.	4.Motivation
18	Q_066	I actively participate in safety training.	2.Commitment
19	Q_068	During preparation execution phase, supervisors/management gives me appropriate advice.	7.Communication

20	Q_069	I respect my supervisors/management because he/she have deep experience and effective skills.	7.Communication
21	Q_093	There is a someone responsible to give advice about industrial safety laws and regulations.	1.Governance
22	Q_095	Senior experts considered and developed based on their experience and skills.	4.Motivation
23	Q_097	Safety practices and activities are shared internally and externally during meeting.	5.Learning
24	Q_100	The safety practices and action plans are discussed with employees.	1.Governance
25	Q_102	Top management visit workplace to communicates and share values on safety with employees.	2.Commitment
26	Q_105	Headquarters auditors are also invited to perform safety audits based on standards.	1.Governance
27	Q_106	During safety audits, working conditions on workplace and safety concerns are grasped through questionnaire or interviews.	1.Governance
28	Q_107	The company has prepared some easy to use document to inform about safety rules and prohibited activities.	1.Governance
29	Q_108	I'm comfortable with my responsibilities.	1.Governance
30	Q_109	Company work satisfaction surveys are conducted and improvement measures are implemented based on feedback.	4.Motivation

Table 21: List of SDM Effective Questions

Summary of SDM questionnaires distribution area:

- Common Area = 26 questions (include 14 complete question pairs)
- Neglected Area = 35 questions
- Independent Area = 19 questions
- Effective Area = 30 questions

4.8 List of ICSI SCAS Questionnaires into SCAS Model Structure

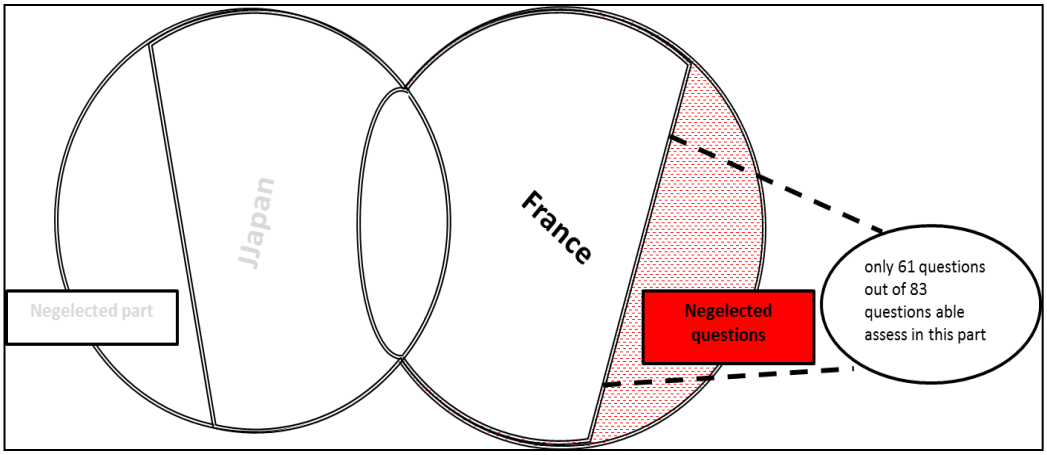


Figure 19: ICSI Neglected Questions in SCAS Model Structure

		ICSI neglected questions	Group
1	Q_131R	The work to be done requires that people act quickly.	1.Organization and work content
2	Q_134	Access to equipment and tools (gauges, valves, panels, ladders) is easy.	4.Ergonomics and .engineering
3	Q_136	Labour relations between middle management and employees are good at this worksite.	1.Organization and work content
4	Q_137	It may happen that the work be stressful.	1.Organization and work content
5	Q_139R	Some written safety rules are not essential to perform tasks safely.	5.Behavioural safety management
6	Q_140	Wrong design of certain equipment is the source of incidents and mistakes.	4.Ergonomics and .engineering
7	Q_144	Safety of installations is adequate.	3.Technical safety management
8	Q_149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	3.Technical safety management
9	Q_150	Safety requirements indicated on work permits are efficient.	3.Technical safety management
10	Q_151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	6.Work team/peer influence
11	Q_152	The HSE Department advises realistic and efficient actions to prevent accidents.	3.Technical safety management
12	Q_154R	Certain physical conditions (temperature, light, confined areas, space congestion, and noise) prevent employees doing the job safely.	4.Ergonomics and engineering
13	Q_155	The work teams have a positive influence on the safety behaviour of each one of the team members.	6.Work team/peer influence
14	Q_156R	The profitability objectives and production targets compromise safety	-
15	Q_161	Top management informs employees on various economic aspects of the company (future projects, challenges ...).	-
16	Q_164R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	3.Technical safety management

17	Q_171	Management / supervisors remind employees about the importance of applying the safety rules.	5.Behavioural safety management
18	Q_172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	3.Technical safety management
19	Q_177R	It is difficult for management / supervisors to combine safety with the other priorities.	2.Management leadership
20	Q_185R	Employees are concerned about the continuity of their employment related to TABK activities.	8.Heath
21	Q_188	Employees put safety as a priority in their work.	7.Employees behaviour
22	Q_189R	Fear of being blamed discourages employees to report certain safety incidents.	5.Behavioural safety management
23	Q_190	Fear of being blamed discourages employees to report certain safety incidents.	5.Behavioural safety management
24	Q_191	Employees wear all personal protective equipment (PPE) required for the task	7.Employees behaviour
25	Q_194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	2.Management leadership
26	Q_195	Employees give advice to each other to work in a safe manner.	6.Work team/peer influence
27	Q_197	Employees make suggestions to improve safety elements of their work.	7.Employees behaviour
28	Q_198R	Safety systems on installations are bypassed by employees.	7.Employees behaviour
29	Q_199	Employees are consulted for improving safety rules to be applied in their work.	5.Behavioural safety management
30	Q_202	The long serving employees pass on their professional knowledge to the newcomers to train them.	6.Work team/peer influence
31	Q_205	Employees apply the rules and procedures set for protecting their health at work.	8.Heath
32	Q_206	Employees are well informed and trained regarding job related health risks.	8.Heath
33	Q_212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	5.Behavioural safety management

Table 22: List of ICSI Neglected Questions

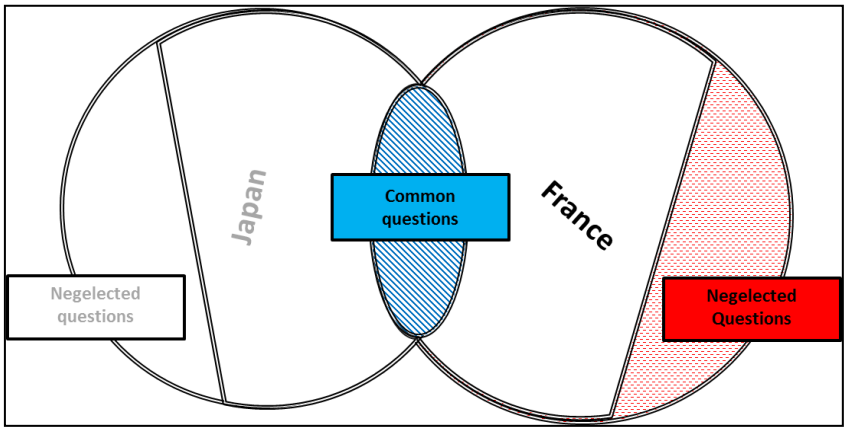


Figure 20: ICSI Common Questions in SCAS Model Structure

		ICSI Common Question List	Group
1	Q_132	Interpersonal relations and communications between employees are good at this worksite.	1.Organization and work content
2	Q_133	Interpersonal relations and communications between departments and trades are good at this worksite.	1.Organization and work content
3	Q_141R	Housekeeping and storage is poor on this worksite.	7.Employees behaviour
4	Q_145R	It may happen that installations are operated in a downgraded situation.	3.Technical safety management
5	Q_147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	3.Technical safety management
6	Q_153	The HSE MS is effective for controlling risks of occupational illnesses.	3.Technical safety management
7	Q_160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	5.Behavioural safety management
8	Q_162	Management / supervisors provide sufficient resources to employees to allow them to do their work safely.	2.Management leadership
9	Q_166	Top management puts a very high priority on safety at work.	2.Management leadership
10	Q_170	Top management has credibility regarding safety at work because they practice what they preach.	2.Management leadership
11	Q_173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	5.Behavioural safety management
12	Q_182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	5.Behavioural safety management
13	Q_183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	5.Behavioural safety management
14	Q_193R	It may happen that some work pressures(rush, unexpected operations, backlog, urgent requests) push employees to bypass written safety rules and take risks	7.Employees behaviour
15	Q_196R	Some written safety rules applicable to routine tasks are bypassed by employees	7.Employees behaviour
16	Q_201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	7.Employees behaviour
17	Q_210R	Employees are overconfident in their own abilities.	7.Employees behaviour

Table 23: List of ICSI common questions

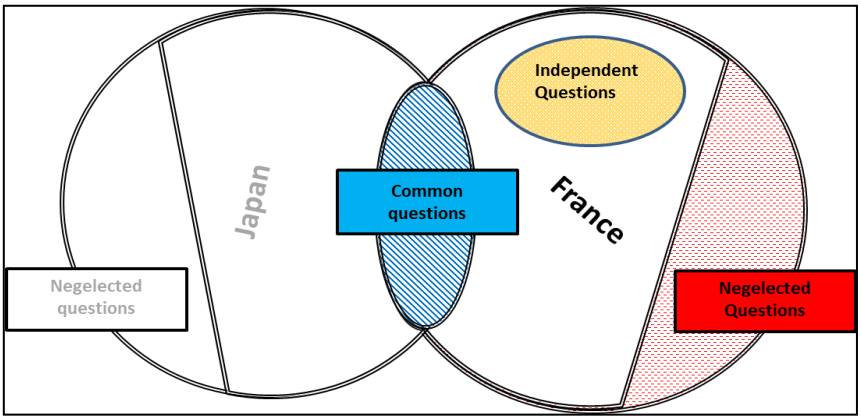


Figure 21: ICSI Independent in SCAS Model Structure

		ICSI Independent Question List	Group
1	Q_135	Personnel worry about maintaining the required level of competencies due to the turnover and/or retirement of employees.	1.Organization and work content
2	Q_138	Investigations conducted following incidents identify the real causes of these events.	3.Technical safety management
3	Q_146	Some personnel shortages prevent employees doing the job safely.	1.Organization and work content
4	Q_158R	It may happen that installations are operated with defective or inoperative safety systems.	3.Technical safety management
5	Q_168	Management / supervisors go to worksites to observe if tasks are performed safely.	5.Behavioural safety management
6	Q_174	Top management puts a higher priority on safety than occupational health risks	-
7	Q_175	Top management ensures that efficient controls for occupational health risks are implemented at the worksite.	8.Heath
8	Q_178	Top management strongly motivates all employees to consider safety a priority at work.	2.Management leadership
9	Q_180R	Some managers / supervisors tolerate dangerous practices at work.	5.Behavioural safety management
10	Q_184	Employees are consulted about changes concerning their work.	1.Organization and work content
11	Q_186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	5.Behavioural safety management
12	Q_187R	Employees use incorrect postures to carry out their tasks.	4.Ergonomics and 5.engineering
13	Q_200	Employees remind each other to comply with the safety rules and procedures applicable to their work.	6.Work team/peer influence
14	Q_209	Employees are adequately informed regarding risks on site.	5.Behavioural safety management
15	Q_211	HSE incentive programs encourage employees to work more safely.	5.Behavioural safety management

Table 24: List of ICSI Independent Questions

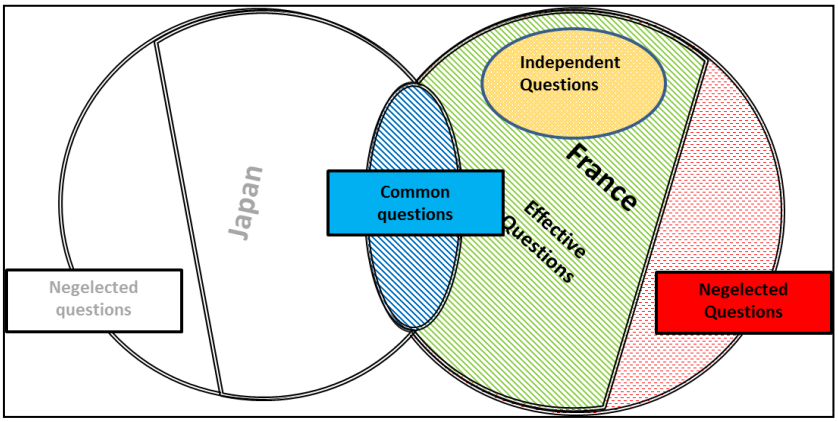


Figure 22: ICSI Effective Questions in SCAS Model Structure

		ICSI Effective Questions List	Group
1	Q_142	The HSE MS used is effective for controlling risks of severe accidents.	3.Technical safety management
2	Q_143	Disciplinary action is taken in case of serious misconduct regarding safety.	5.Behavioural safety management
3	Q_148	Emergency drills are done seriously.	7.Employees behaviour
4	Q_157	The work permit process makes it possible to control the risks of the work to be done	-
5	Q_159	Management / supervisors put a higher priority on safety than on production.	2.Management leadership
6	Q_163	Supervisors react immediately if they observe an employee working unsafely.	5.Behavioural safety management
7	Q_165	Management / supervisors encourage employees to report all safety problems at work.	3.Technical safety management
8	Q_167	Management / supervisors put priority on safety only after an accident has occurred.	2.Management leadership
9	Q_169	Management / supervisors act rapidly as soon as a safety concern is reported.	3.Technical safety management
10	Q_176	Top management puts a higher priority on safety rather than environmental risk	-
11	Q_179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	-
12	Q_181	During site visits, top management communicates in a constructive manner with employees.	2.Management leadership
13	Q_192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	6.Work team/peer influence
14	Q_203	Employees are well informed and trained regarding job related environmental risks.	5.Behavioural safety management
15	Q_204	Employees implement the rules and procedures set to protect the environment	-
16	Q_207	Anomaly card system leads to real improvements.	3.Technical safety management
17	Q_208	Employees receive feedback on the anomaly cards they submit.	3.Technical safety management
18	Q_213	Employees separate waste according to site rules.	9.Environment

Table 25: List of ICSI Effective Questions

Summary of ICSI questionnaires distribution area:

- Common Area = 17 questions (including 14 complete question pairs)
- Neglected Area = 33 questions
- Independent Area = 15 questions
- Effective Area = 18 questions

4.9 Final Integrated SCAS Questions

After identify SDM and ICSI SCAS questionnaires into their SCAS model area, there is total 111 Integrated SCAS questionnaires as below that can be used for Japan and France's chemical industries as table below:

Indicator	Core SCAS questions
	SDM SCAS questions
	ICSI SCAS questions
	Completely same questions

	Integrated SCAS Question List (SDM Version)		Axis
1	Q_004	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	7.Communication
2	Q_005	Interpersonal relations between employees are good at this worksite.	7.Communication
3	Q_012	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	5.Learning
4	Q_031	Good housekeeping / storage and work area organization is in place.	6.Awareness
5	Q_046R	Equipment and installation were used passed their service life.	2.Commitment
6	Q_049	Work habits take priority over rules and regulations.	1.Governance
7	Q_050	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	2.Commitment
8	Q_057	The environmental conditions of the work area are in accordance with regulated occupational health standards.	6.Awareness
9	Q_077	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	4.Motivation

10	Q_084R	There are opportunities for us to bypass safety rules under time pressure or non-essential rules.	8.Work Management
11	Q_085R	I believe that professionals are able to perform even dangerous work.	8.Work Management
12	Q_088	In case of concern or safety issues, budgets are always available.	1.Governance
13	Q_096	Coordination, collaboration and communication between departments are good.	7.Communication
14	Q_098	Top management communicates and show that they put a high priority on safety.	1.Governance
15	Q_001	The company makes consideration to create a pleasant work atmosphere for sub-contacting employees.	4.Motivation
16	Q_007	Supervisors / managers have good understanding of their employee's jobs / responsibilities / progress.	7.Communication
17	Q_009	Sub-contractor employees receive sufficient training on the safety.	3.Resource Management
18	Q_010	The sub-contracting company is implementing its own safety activities.	3.Resource Management
19	Q_011	There are some formal and informal events that company and sub-contracting company employees can attend.	3.Resource Management
20	Q_013	During On the Job Training, safety is highly emphasized as very important.	5.Learning
21	Q_014	Rules and procedures are properly revised, understood and used.	5.Learning
22	Q_016	Important technical skills must be listed, and program is in place to transmit this information without any omissions.	5.Learning
23	Q_017	For planning maintenance shutdown, previous accomplishments are considered.	8.Work Management
24	Q_018R	Role and responsibilities are ambiguous within the workplace.	1.Governance
25	Q_020	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	1.Governance
26	Q_021	During discussion with management, employees have clear understanding of personnel evaluation and goals.	4.Motivation
27	Q_028	Technical information is shared between maintenance department and operations department.	3.Resource Management
28	Q_029	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	6.Awareness
29	Q_030	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	6.Awareness
30	Q_034	Experience related to past accidents, incidents and human behaviours are taken in consideration in work standards and procedures.	5.Learning
31	Q_035	There are systematic skills training programs available which people can attend based on their skill level.	5.Learning
32	Q_036	Good conditions of equipment (such as the pumps) are continually inspected, and any abnormalities are reported.	8.Work Management
33	Q_037	Initiative and attitudes for safety actions are promoted and included in the personnel evaluations.	2.Commitment
34	Q_039	Any concerns and/or requests from the sub-contractors are reported to the company management and are promptly taken care of.	7.Communication
35	Q_040	Non real information and rumours are incorrectly reported.	7.Communication
36	Q_042	Managements and supervisors take serious consideration about your job and your future.	3.Resource Management
37	Q_044	Employee could be blamed after an incident caused by personal error or mistake.	6.Awareness
38	Q_045	The labelling, colour code, signs and hazard limits are consistent.	6.Awareness

39	Q_047	Management of change for equipment and procedures are clearly defined and implemented.	8.Work Management
40	Q_048	When implementing change, permission by expert supervisor is required.	8.Work Management
41	Q_051R	In case of new installation or maintenance, review procedures are insufficiently organized.	2.Commitment
42	Q_052R	Equipment is operated systematically above normal design conditions.	3.Resource Management
43	Q_053	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	6.Awareness
44	Q_054	There are systematic symbols/numbers labelled on the important components, such as valves/plumbing/pumps, and it coincides with the P &ID.	6.Awareness
45	Q_055	The important valves are labelled with tags (Open/ close/ do not operate).	6.Awareness
46	Q_056	Lockout / tag out procedures are used during work, and permission is granted by the shift supervisor.	6.Awareness
47	Q_058	There is a system in place to report, handle and revise non-compliance situation.	6.Awareness
48	Q_060	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	6.Awareness
49	Q_061	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	6.Awareness
50	Q_062	Accident and incidents records are organized in database and used for daily safety activities or training	6.Awareness
51	Q_063	My supervisor/management trusts my technical strengths/abilities.	4.Motivation
52	Q_064	I get satisfaction from my job.	4.Motivation
53	Q_065	Participating in symposiums/conventions/seminars related to safety is encouraged.	2.Commitment
54	Q_066	I actively participate in safety training.	2.Commitment
55	Q_067	I trust the sub-contractors technical competency.	7.Communication
56	Q_068	During preparation execution phase, supervisors/management give me appropriate advice.	7.Communication
57	Q_069	I respect my supervisors/management because he/she have deep experience and effective skills.	7.Communication
58	Q_074	I take priority to finish a task quickly rather than completing task using a safe and reliable method.	8.Work Management
59	Q_076	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	1.Governance
60	Q_080	There is a systematic training program to improve expertise on specific installation.	3.Resource Management
61	Q_081	I often visit on-site to find anomalies in equipment.	8.Work Management
62	Q_082	I always use standard operation procedures and checklists.	8.Work Management
63	Q_091	Our company has a system to develop HSE specialists.	1.Governance
64	Q_093	There is a someone responsible to give advice about industrial safety laws and regulations.	1.Governance
65	Q_095	Senior experts considered and developed based on their experience and skills.	4.Motivation
66	Q_097	Safety practices and activities are shared internally and externally during meeting.	5.Learning

67	Q_099	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	1.Governance
68	Q_100	The safety practices and action plans are discussed with employees.	1.Governance
69	Q_102	Top management visit workplace to communicates and share values on safety with employees.	2.Commitment
70	Q_103	Management communicate directly with employees about safety actions.	2.Commitment
71	Q_105	Headquarters auditors are also invited to perform safety audits based on standards.	1.Governance
72	Q_106	During safety audits, working conditions on workplace and safety concerns are grasped through questionnaire or interviews.	1.Governance
73	Q_107	The company has prepared some easy to use document to inform about safety rules and prohibited activities.	1.Governance
74	Q_108	I'm comfortable with my responsibilities.	1.Governance
75	Q_109	Company work satisfaction surveys are conducted and improvement measures are implemented based on feedback.	4.Motivation

Table 26: List of SDM SCAS Questions which is Integrated SCAS Candidate Questionnaires that can be used in Japan and France's Chemical Companies

		Integrated SCAS Question List (ICSI Version)	Group
1	Q_132	Interpersonal relations and communications between employees are good at this worksite.	1.Organization and work content
2	Q_133	Interpersonal relations and communications between departments and trades are good at this worksite.	1.Organization and work content
3	Q_141R	Housekeeping and storage is poor on this worksite.	7.Employees behaviour
4	Q_145R	It may happen that installations are operated in a downgraded situation.	3.Technical safety management
5	Q_147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	3.Technical safety management
6	Q_153	The HSE MS is effective for controlling risks of occupational illnesses.	3.Technical safety management
7	Q_160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	5.Behavioural safety management
8	Q_162	Management / supervisors provide sufficient resources to employees to allow them to do their work safely.	2.Management leadership
9	Q_166	Top management puts a very high priority on safety at work.	2.Management leadership
10	Q_182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	5.Behavioural safety management
11	Q_183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	5.Behavioural safety management
12	Q_193R	It may happen that some work pressures(rush, unexpected operations, backlog, urgent requests) push employees to bypass written safety rules and take risks	7.Employees behaviour
13	Q_196R	Some written safety rules applicable to routine tasks are bypassed by employees	7.Employees behaviour
14	Q_210R	Employees are overconfident in their own abilities.	7.Employees behaviour

15	Q_135	Personnel worry about maintaining the required level of competencies due to the turnover and/or retirement of employees.	1.Organization and work content
16	Q_138	Investigations conducted following incidents identify the real causes of these events.	3.Technical safety management
17	Q_142	The HSE MS used is effective for controlling risks of severe accidents.	3.Technical safety management
18	Q_143	Disciplinary action is taken in case of serious misconduct regarding safety.	5.Behavioural safety management
19	Q_146	Some personnel shortages prevent employees doing the job safely.	1.Organization and work content
20	Q_148	Emergency drills are done seriously.	7.Employees behaviour
21	Q_157	The work permit process makes it possible to control the risks of the work to be done	-
22	Q_158R	It may happen that installations are operated with defective or inoperative safety systems.	3.Technical safety management
23	Q_159	Management / supervisors put a higher priority on safety than on production.	2.Management leadership
24	Q_163	Supervisors react immediately if they observe an employee working unsafely.	5.Behavioural safety management
25	Q_165	Management / supervisors encourage employees to report all safety problems at work.	3.Technical safety management
26	Q_167	Management / supervisors put priority on safety only after an accident has occurred.	2.Management leadership
27	Q_168	Management / supervisors go to worksites to observe if tasks are performed safely.	5.Behavioural safety management
28	Q_169	Management / supervisors act rapidly as soon as a safety concern is reported.	3.Technical safety management
29	Q_170	Top management has credibility regarding safety at work because they practice what they preach.	2.Management leadership
30	Q_173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	5.Behavioural safety management
31	Q_174	Top management puts a higher priority on safety than occupational health risks	-
32	Q_175	Top management ensures that efficient controls for occupational health risks are implemented at the worksite.	8.Heath
33	Q_176	Top management puts a higher priority on safety rather than environmental risk	-
34	Q_178	Top management strongly motivates all employees to consider safety a priority at work.	2.Management leadership
35	Q_179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	-
36	Q_180R	Some managers / supervisors tolerate dangerous practices at work.	5.Behavioural safety management
37	Q_181	During site visits, top management communicates in a constructive manner with employees.	2.Management leadership
38	Q_184	Employees are consulted about changes concerning their work.	1.Organization and work content

39	Q_186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	5.Behavioural safety management
40	Q_187R	Employees use incorrect postures to carry out their tasks.	4.Ergonomics and 5.engineering
41	Q_192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	6.Work team/peer influence
42	Q_201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	7.Employees behaviour
43	Q_200	Employees remind each other to comply with the safety rules and procedures applicable to their work.	6.Work team/peer influence
44	Q_203	Employees are well informed and trained regarding job related environmental risks.	5.Behavioural safety management
45	Q_204	Employees implement the rules and procedures set to protect the environment	-
46	Q_207	Anomaly card system leads to real improvements.	3.Technical safety management
47	Q_208	Employees receive feedback on the anomaly cards they submit.	3.Technical safety management
48	Q_209	Employees are adequately informed regarding risks on site.	5.Behavioural safety management
49	Q_211	HSE incentive programs encourage employees to work more safely.	5.Behavioural safety management
50	Q_213	Employees separate waste according to site rules.	9.Environment

Table 27: List of ICSI SCAS Questions which is Integrated SCAS Candidate Questionnaires that can be used in Japan and France's Chemical Companies

Integrated SCAS Questionnaires (SDM Version) :

75 (Integrated SDM SCAS Candidate Questions) + 50 (Integrated ICSI SCAS Candidate questions) – 14 (Common ICSI questions) = 111 Integrated SCAS Questionnaires (SDM Version)

Integrated SCAS Questionnaires (ICSI Version):

50 (Integrated ICSI SCAS Candidate Questions) + 75 (Integrated SDM SCAS Candidate Questions) – 14 (Common SDM questions) = 111 Integrated SCAS Questionnaires (ICSI Version)

4.10 Summary Result of Overall SCAS Distribution Result

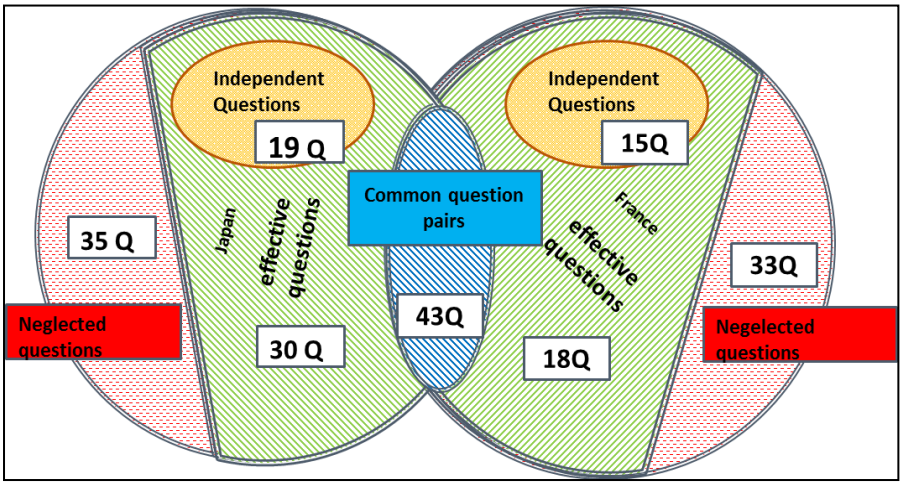


Figure 23: Summary Number Questions Distribution Result in SCAS Model Structure

SCAS Model area	SDM		ICSI	
	Number of Questions	% of Total data	Number of Questions	% of Total data
Completely Common	14	13%	14	17%
Common	12	11%	3	4%
Neglected	35	32%	33	40%
Independent	19	17%	15	18%
Effective	30	27%	18	22%

Table 28: Summary of Questions Distribution Result in SCAS Model Structure

From **Table 28** above, it can see that distribution of common area, neglected area, independent area and effective area between SDM and ICSI after organize data into SCAS model are quite same distribution.

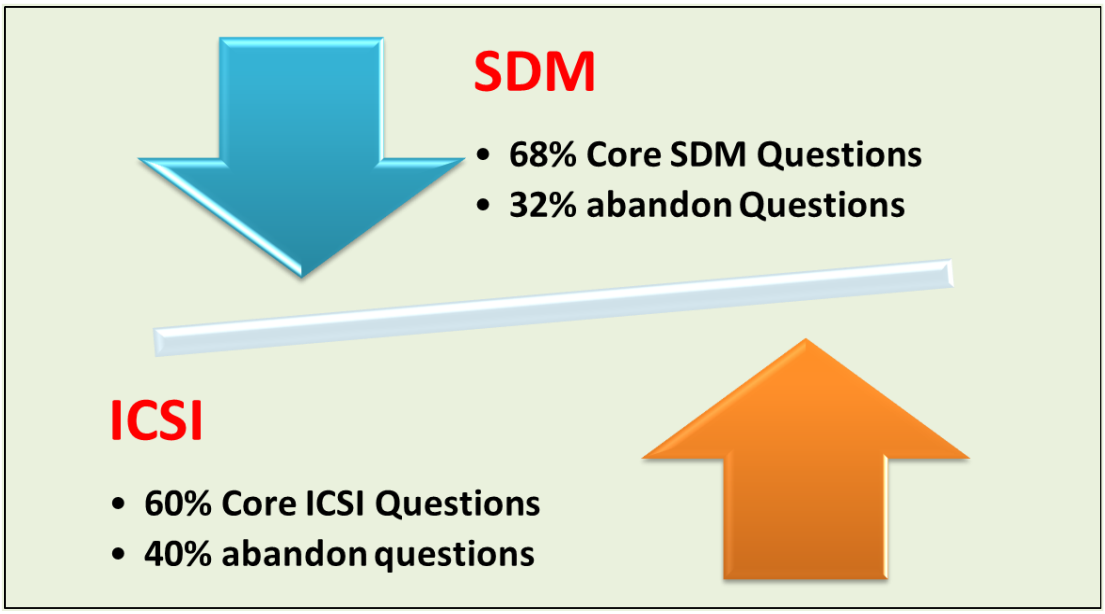


Figure 24: Summary Result of % SDM or ICSI Integrated questions by Total 110 SDM Questions and 83 SDM questions

At the beginning, target 100 Integrated SCAS Questionnaires was set due to considering the ability and tolerance of company's employees in participating SCAS questionnaire's activity. However, 111 Core SCAS questions were achieved due to reasons for SDM and ICSI data balancing and they consist important safety culture assessment ability, and it is only 1% different out of total 193 questions. It is under reasonable tolerance.

From **Figure 24** above, it showed that result of percentage questions in data balancing after decide Integrated SCAS questionnaires candidate which consist of SDM SCAS questions and ICSI SCAS questions. % abandon questions from original 110 SDM SCAS questions are 32% while 40% of original 83 ICSI SCAS questions have been abandoned. From **Figure 24**, it showed good balancing for dropping ineffective safety culture assessment questions in SDM or ICSI SCAS questions which are decided by accident rate data and expert judge. The reasons for balancing % drop question in SDM and ICSI SCAS data are due to we need have new integrated questionnaires which relate to SDM past data base and maintaining good collaboration continually with ICSI side.

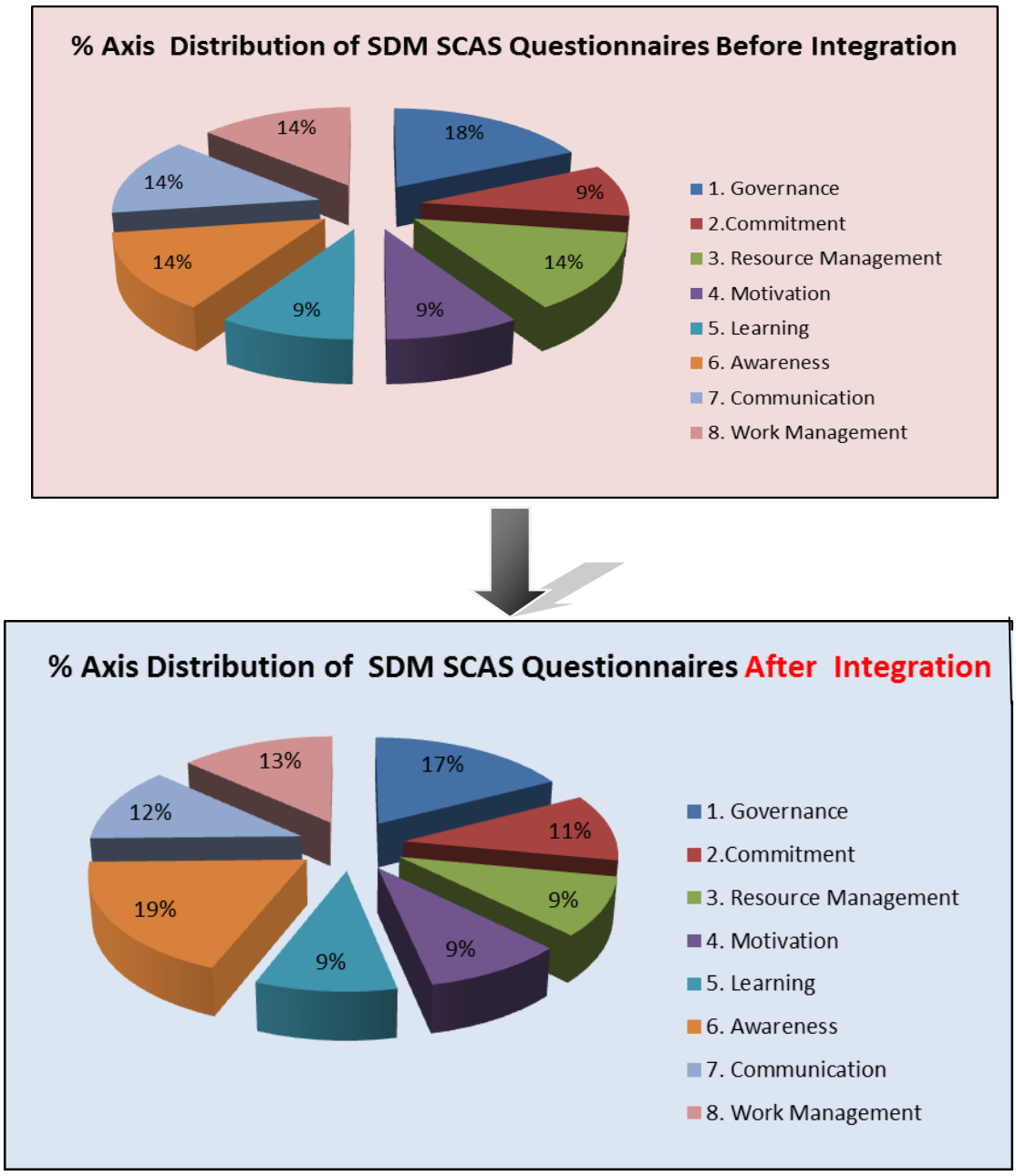


Figure 25: Comparison % Axes Distribution of SDM Questionnaires Before and After Integrate SCAS Questionnaires

From **Figure 25** above, it can see that % axis distribution in 110 SDM SCAS questions and 75 SDM SCAS Questions are having similar % axis distribution. Top three highest important Axes in 110 SDM SCAS questions are **Governance, Resource Management, Learning and Communication**. And Top three highest important Axes in 75 SDM SCAS questions are **Governance, Awareness and Communication.**

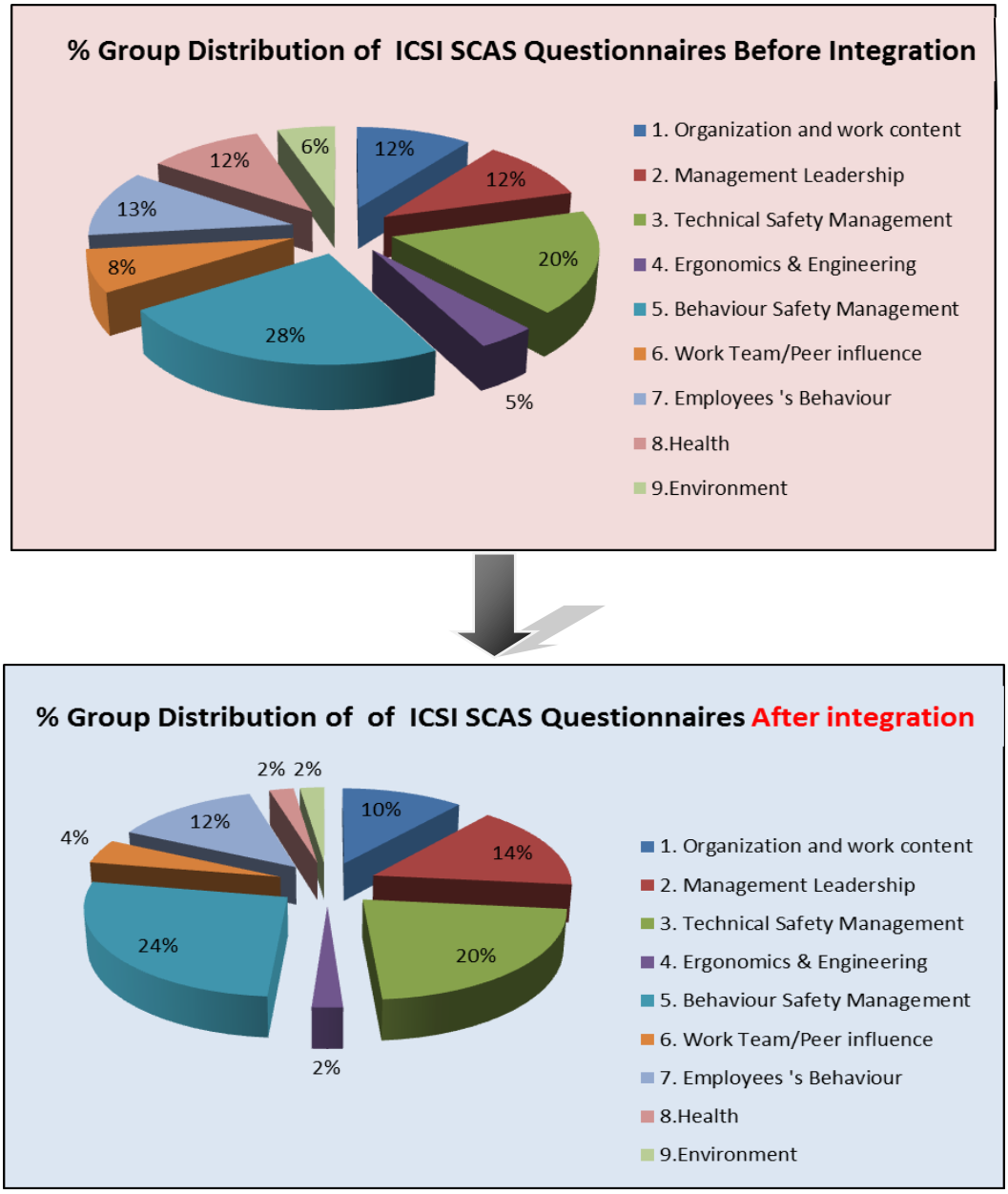
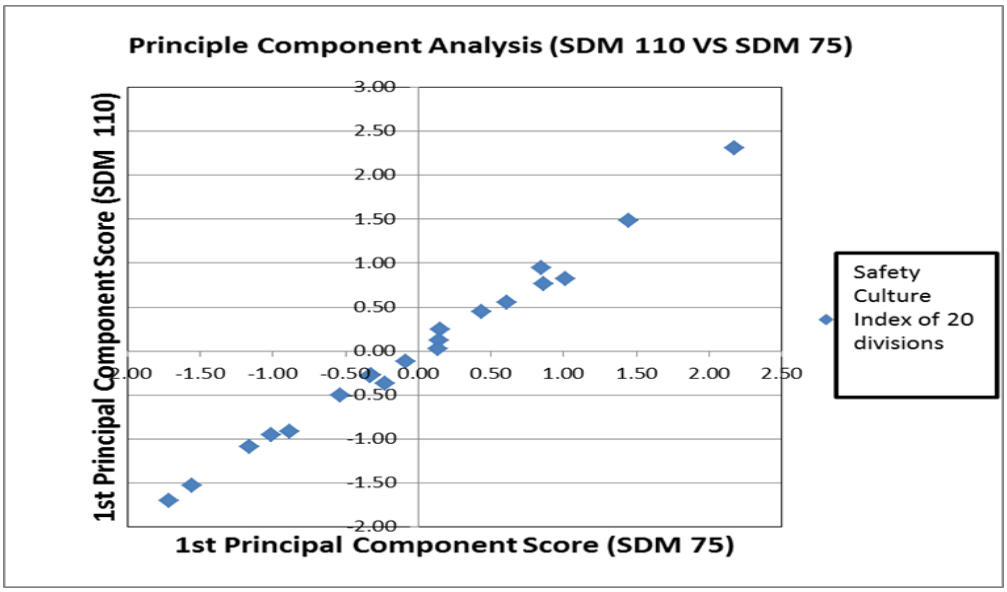


Figure 26: Comparison % Group Distribution of SDM Questionnaires Before and After Integrate SCAS Questionnaires

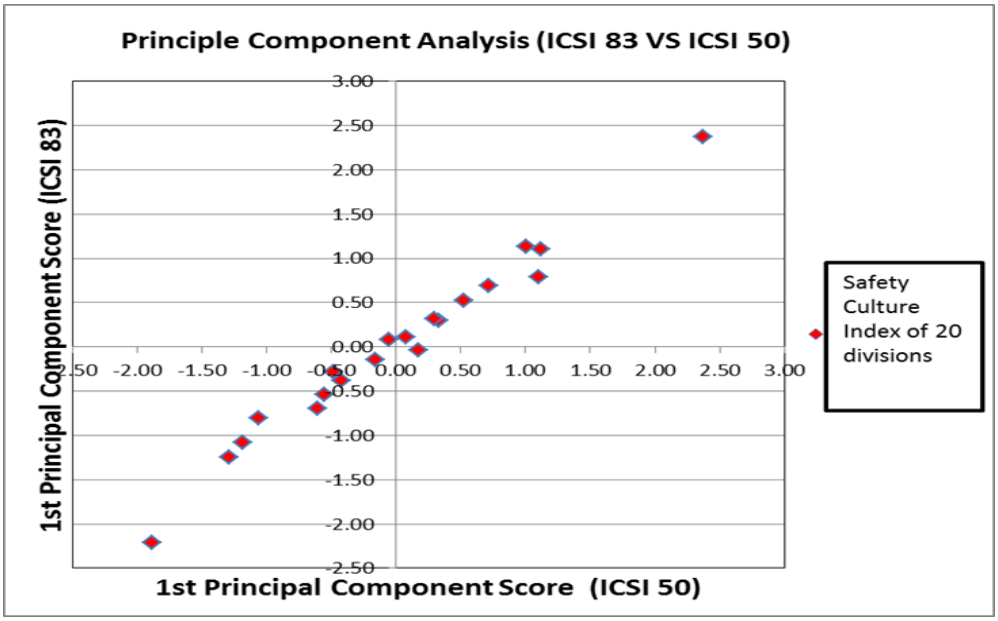
From **Figure 26** above, it can see that % group distribution in 83 ICSI SCAS questions and 50 ICSI SCAS Questions are having similar % group distribution. Top three highest important Groups in original ICSI SCAS questions are **Behavioural Safety Management, Technical Safety Management and Employee's Behaviour.** And Top three highest important groups in 50 ICSI SCAS questions are **Behaviour Safety Management, Technical Safety Management and Management Leadership.**

The similar axis distribution result showed we don't lose any aspects or areas of safety culture assessment system after integration SCAS questionnaires from SDM and ICSI.

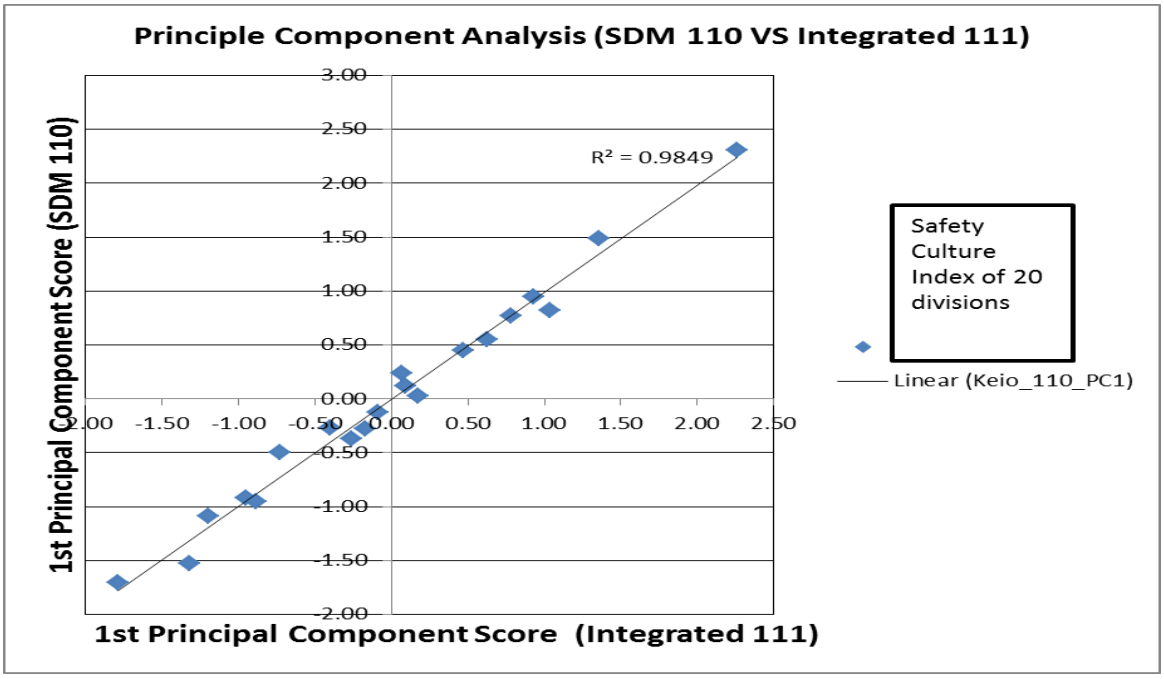
4.11 Validation Result by Principle Component Analysis



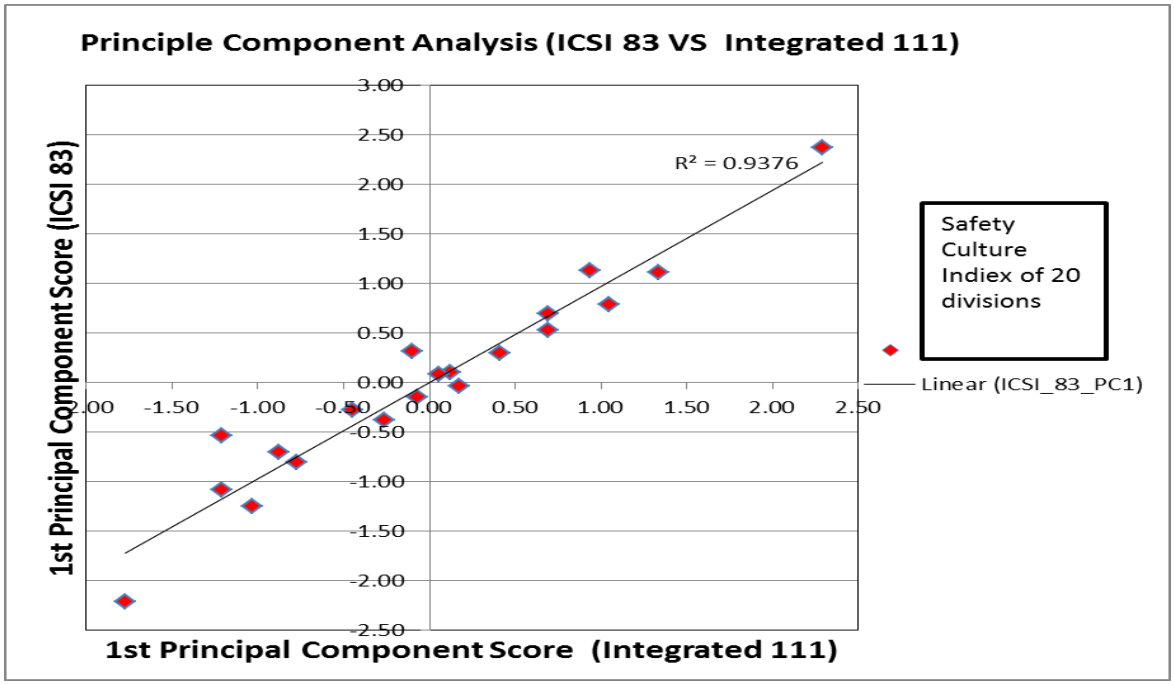
Graph 1: The Obtained Result by applying Principle Component Analysis to visualize the Overall Distribution 20 sections of Japan Chemical Company A by 75 SDM Questions



Graph 2: The Obtained Result by applying Principle Component Analysis to visualize the Overall Distribution 20 sections of Japan Chemical Company A by 50 ICSI Questions



Graph 3: The Obtained Result by applying Principle Component Analysis to visualize the Overall Distribution 20 sections of Japan Chemical Company A by 110 SDM SCAS Questions and 111 Integrated SCAS Questions



Graph 4: The Obtained Result by applying Principle Component Analysis to visualize the Overall Distribution 20 sections of Japan Chemical Company A by 110 SDM SCAS Questions and 111 Integrated SCAS Questions

In this research paper, we applied the principle component analysis as one of mulvariate analysis as **Graph 1, 2, 3 and 4** in orders to make overall viewpoint on following:

- Overall distribution of 20 sections of Japan Chemical Data A with 75 SDM SCAS Questions
- Overall distribution of 20 sections of Japan Chemical Data A with 50 ICSI SCAS Questions
- Overall distribution of 20 sections of Japan Chemical Data A with 111 Integrated SCAS Questions (SDM version)
- Overall distribution of 20 sections of Japan Chemical Data A with 111 Integrated SCAS Questions (ICSI version)

The graph includes 20 sections in Japan Chemical Company A which are plant, Top management, HSE division, Production Planning Division, Maintenance division, Quality Assurance division, Butanediol production, polyolefin planning division, polymer production, polystyrene production, chemical production 1 & 2, Ethylene production division, polyethylene production system, functional resin production division 1 &2, , functional chemical production division, compound production division, machinery division and instrument division.

The first principal component is strongly correlated with the 110 SDM Questionnaires and 83 ICSI Questionnaires called as original variables. The first principal component increases with increasing 75 SDM SCAS Questionnaires scores, 50 ICSI SCAS Questionnaires scores, 111 Integrated SCAS Questionnaires of SDM version scores and Integrated ICSI Questionnaires of ICSI version. This suggests that these four criteria showed similar result to. If x-axis (1^{st} Principle Component score increases, then the remaining four scores in Y-axis also increase. Furthermore, we see that the first principal component correlates strongly with the all other 4 scores in y-axis in all graphs. In fact, we could state that based on the correlation significant of 0.985 in **Graph 3** and correlation significant of 0.938 in **Graph 4**, it showed very good correlation result between x-axis first principle component with y-axis first principle

component scores in **Graph 3 and Graph 4** even though this research data are considered as random variable in linear trend.

As summary, this study reach conclusion that x-axis was corresponding and can called as Safety Culture Index (SCI) as first component score. This value is significantly relate with Japan Chemical Company A as total 110 SDM SCAS questions and 83 SDM SCAS questions respectively which corresponding as below summary:

- **Graph 1**: 75 SDM SCAS questions has same trend with original 110 SDM SCAS questions that have same safety level assessment ability as 110 SDM SCAS questions.

- **Graph 2**: 50 ICSI SCAS questions has same trend with original 83 ICSI SCAS questions that have same safety level assessment ability as 83 ICSI SCAS questions.

- **Graph 3**: 111 Integrated SCAS Questions (SDM version) has tendency which is same trend with original 110 SDM questions that have same measurement standard for organization's safety culture and also 111 Integrated SCAS Questions (SDM version) has the ability to replace total 193 SDM and ICSI SCAS questions in safety level assessment ability as result showed in **Graph 3.**

- **Graph 4**: 111 Integrated SCAS Questions (ICSI version) has tendency which is same trend with original 83 SDM questions that have same measurement standard for organization's safety culture and also 111 Integrated SCAS Questions (ICSI version) has the ability to replace total 193 SDM and ICSI SCAS questions in safety level assessment ability as result showed in **Graph 4.**

5.0 Conclusion

As summary, this research succeeds to integrate common and effective Safety Culture Assessment System (SCAS) questionnaires and create Integrated SCAS questionnaires structure between Japan and France. The Integrated SCAS questions able to assess and judge companies safety level at Japan and France and it can be expanded for world-wide application. This indirectly improves safety culture leading to reduce various industrial incidents which can save human life, prevent money loss and increase safety level by questionnaires judgement in chemical industry.

Items	Summary Result	Current research
1.) Find Common SCAS question pairs between Japan and France	**`14 completely same question pairs**	**Done**
2)Determine Common SCAS questionnaires between Japan and France	**Total 43 common questions**	**Done**
3) Identify and grouping SDM and ICSI SCAS questionnaires into SCAS model	**Allocate questions into SCAS model**	**Done**
4) Find Standard Value in correlation analysis as that used to identify effective SCAS questionnaires	**Above 0.35**	**Done**
5) Validation Result from Japan Chemical Company A by principle component analysis	**There have tendency that new 111 SDM or ICSI Core SCAS questions that have same measurement ability in safety level assessment with original SDM and ICSI SCAS questions.**	**Done**

Figure 27: Overall Conclusion of This Research

6.0 Future Research

6.1 Difficulties of this research

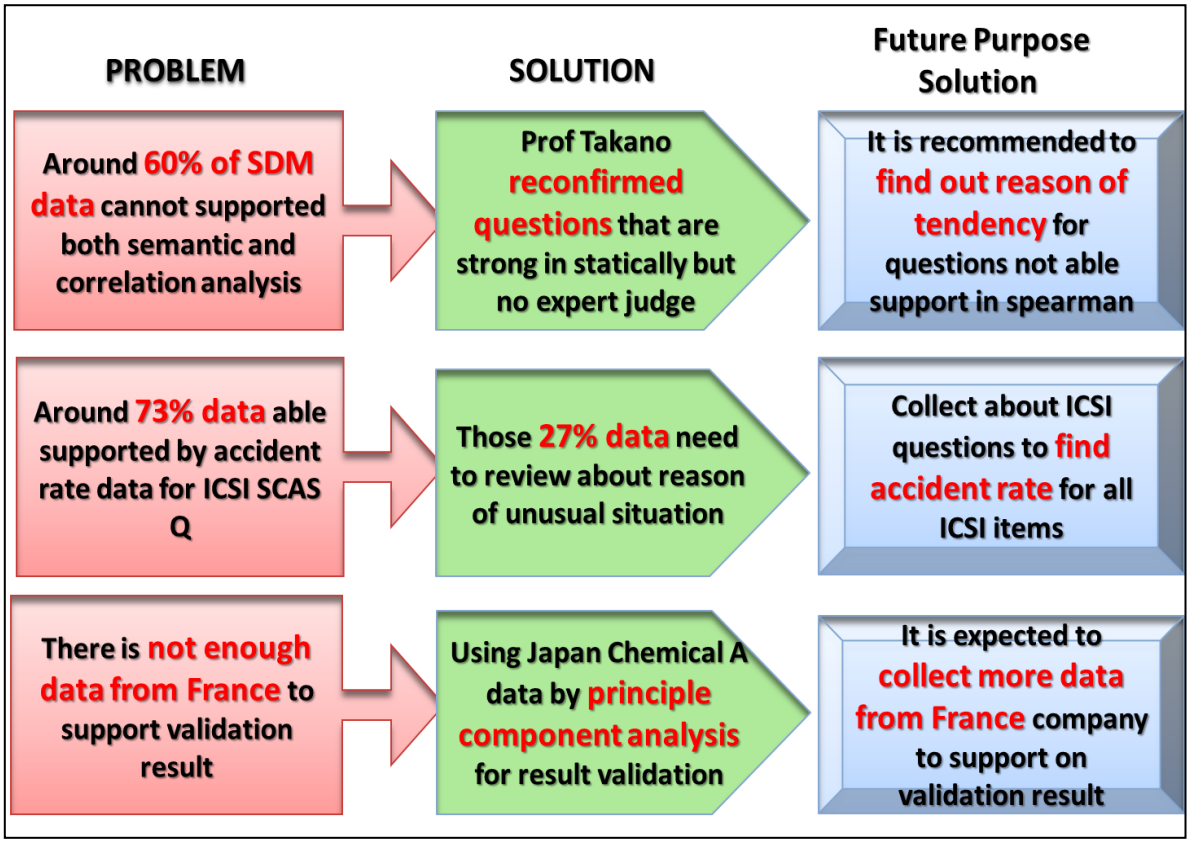


Figure 28: Difficulties faced on this Research Paper

6.2 Future Research Plan

For future of this research, this research main goal is to establish Safety Culture Assessment System Questionnaires that can be used for world-wide application in chemical industries. In order to achieve develop standard and Integrated SCAS that can be used universally, this research is expected to continue by join research to other subsidy companies in USA, Asia and so on. And finally generate integrate SCAS questionnaires that applicable for world-wide.

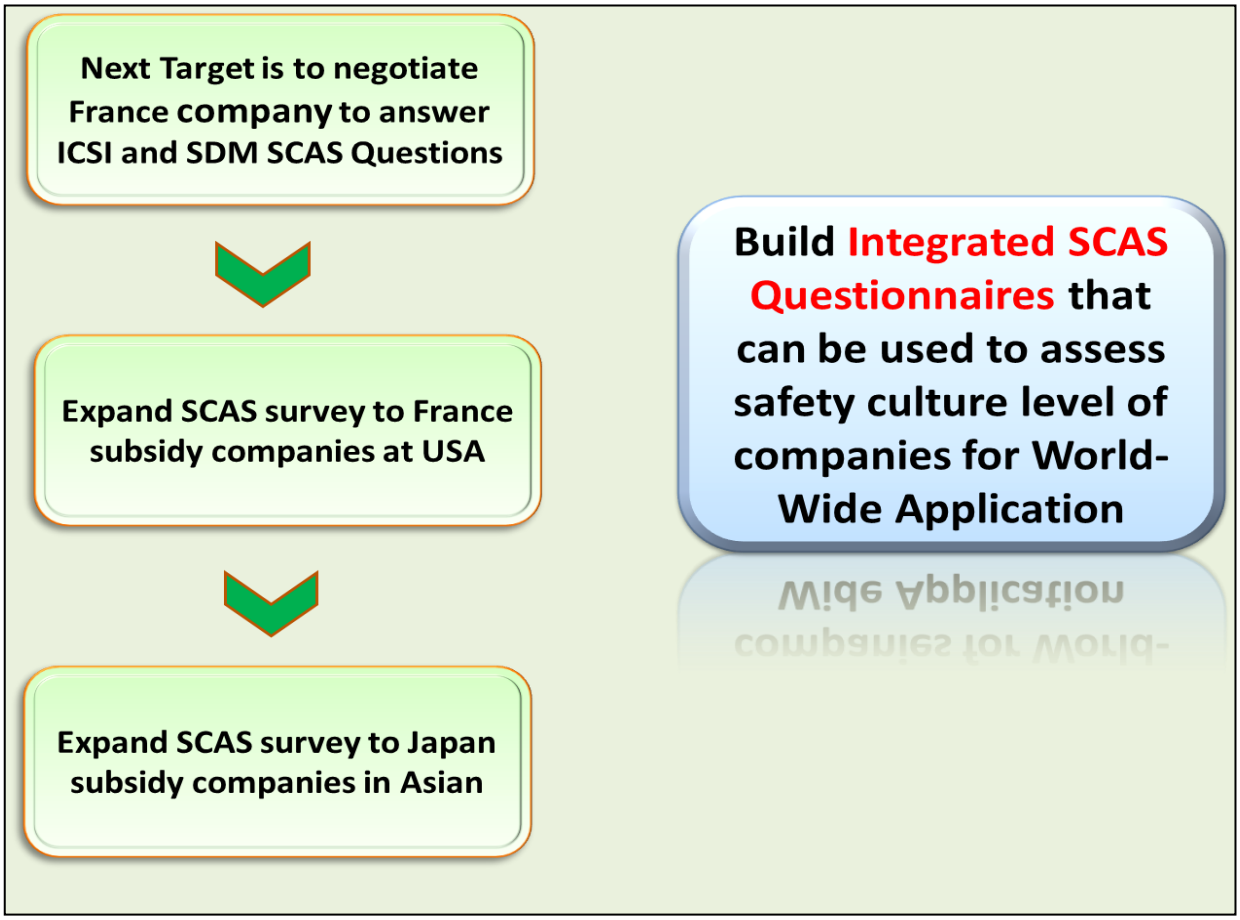


Figure 29: Future Study Plan

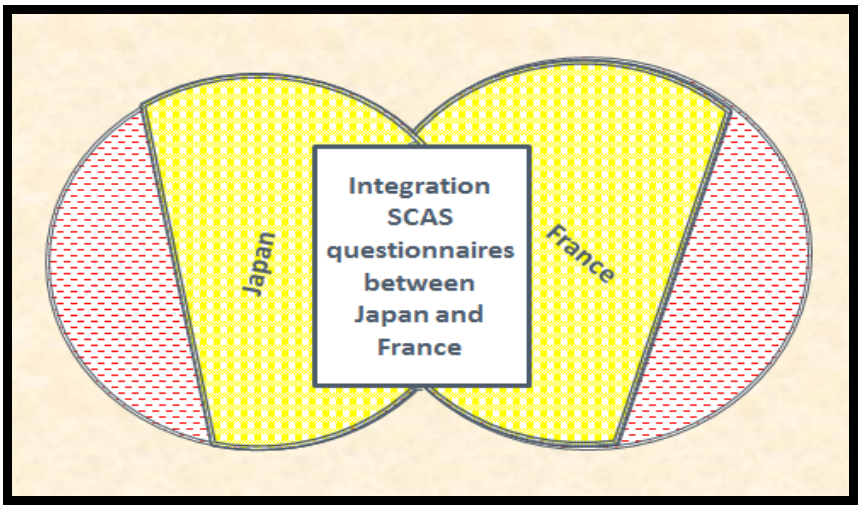


Figure 30: Integration SCAS Questionnaires between Japan and France

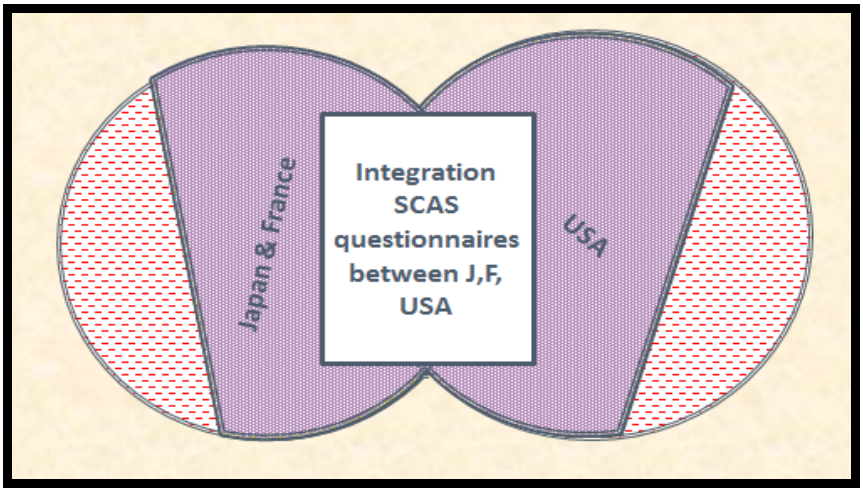


Figure 31: Integration SCAS Questionnaires between Japan, France, and USA

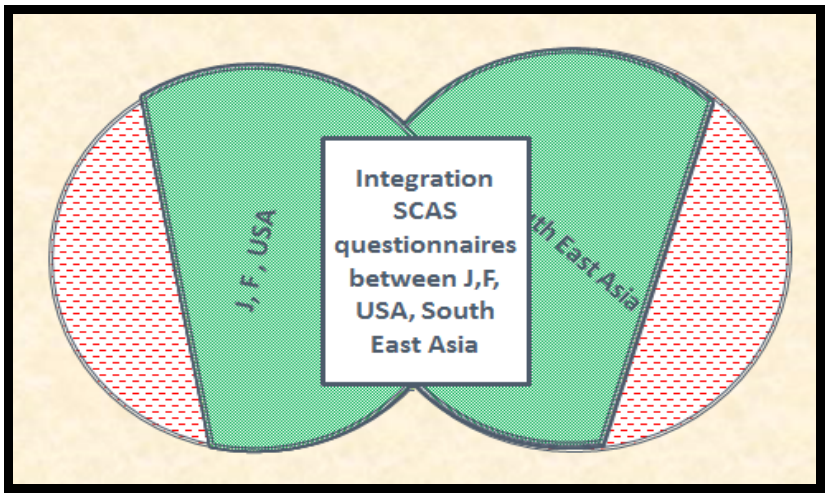


Figure 32: Integration SCAS Questionnaires between Japan, France, USA, and South East Asia

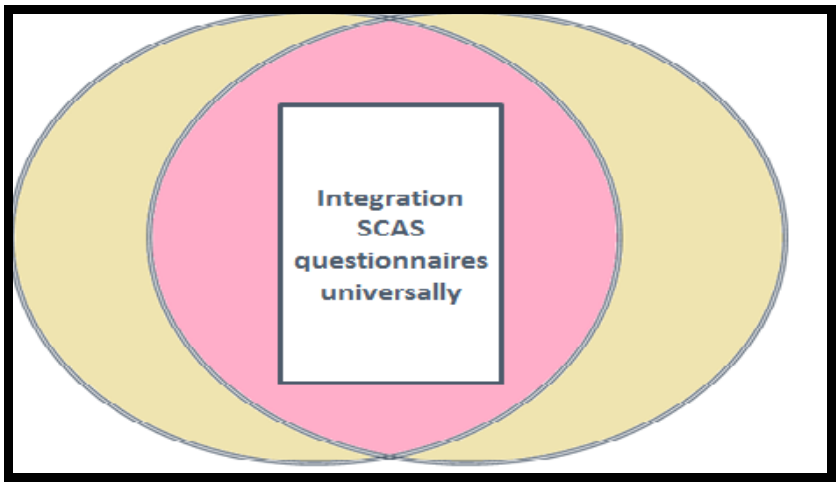


Figure 33: Integration SCAS Questionnaires Globally

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8.0 APPENDIX

8.1 Introduction SDM SCAS Questionnaires

	SDM questionnaires	Axis	Level
1	The company makes consideration to create a pleasant work atmosphere for sub-contacting employees.	4.Motivation	2.Team
2	Teammates are highly motivated to work together focused on improvement.	4.Motivation	2.Team
3	I do not hesitate to communicate about my concerns and request with colleague.	7.Communication	2.Team
4	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	7.Communication	2.Team
5	Interpersonal relations between employees are good at this worksite.	7.Communication	2.Team
6	Employees are able to freely express their opinion regardless of their position or experience.	7.Communication	2.Team
7	Supervisors / managers have good understanding of their employee's jobs / responsibilities / progress.	7.Communication	2.Team
8	Some departments or individuals use too much overtimes to perform their jobs.	3.Resource Management	2.Team
9	Sub-contractor employee receives sufficient training on the safety.	3.Resource Management	2.Team
10	The sub-contracting company is implementing its own safety activities.	3.Resource Management	2.Team
11	There are some formal and informal events that company and sub-contracting company employees can attend.	3.Resource Management	2.Team
12	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	5.Learning	2.Team
13	During On the Job Training, safety is highly emphasized as very important.	5.Learning	2.Team
14	Rules and procedures are properly revised, understood and used.	5.Learning	2.Team
15	In order to improve operational skills, one-on-one guidance is given by experienced co-workers.	5.Learning	2.Team
16	Important technical skills must be listed, and program is in place to transmit this information without any omissions.	5.Learning	2.Team

17	For planning maintenance shutdown, previous accomplishments are considered.	8.Work Management	2.Team
18	Role and responsibilities are ambiguous within the workplace.	1.Governance	2.Team
19	Employees are open to changes and modification of organization and system.	1.Governance	2.Team
20	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	1.Governance	2.Team
21	During discussion with management, employees have clear understanding of personnel evaluation and goals.	4.Motivation	2.Team
22	Employees always work hard for continuous improvement.	4.Motivation	2.Team
23	Management participates in safety education and training with constructive manner.	2.Commitment	2.Team
24	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	7.Communication	2.Team
25	People collaborate to help each other when work is unbalance between departments or employees.	7.Communication	2.Team
26	There are too many useless or inefficient meetings.	3.Resource Management	2.Team
27	There is an age imbalance in the composition of the employees and the transition of technical skills cannot be completed smoothly.	3.Resource Management	2.Team
28	Technical information is shared between maintenance department and operations department.	3.Resource Management	2.Team
29	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	6.Awareness	2.Team
30	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	6.Awareness	2.Team
31	Good housekeeping / storage and work area organization is in place.	6.Awareness	2.Team
32	Hazardous areas and operational hazards are properly labelled to make people aware.	6.Awareness	2.Team
33	Best safety measures and practices from other plants/other companies are introduced and implemented.	5.Learning	2.Team
34	Experience related to past accidents, incidents and human behaviours are taken in consideration in work standards and procedures.	5.Learning	2.Team

35	There are systematic skills training programs available which people can attend based on their skill level.	5.Learning	2.Team
36	Good conditions of equipment (such as the pumps) are continually inspected, and any abnormalities are reported.	8.Work Management	2.Team
37	Initiative and attitudes for safety actions are promoted and included in the personnel evaluations.	2.Commitment	2.Team
38	Safety initiatives are shared with entire workforce, and excellent actions are acknowledged.	2.Commitment	2.Team
39	Any concerns and/or requests from the sub-contractors are reported to the company management and are promptly taken care of.	7.Communication	2.Team
40	Non real information and rumours are incorrectly reported.	7.Communication	2.Team
41	Managers and employees try to reduce amount of work by revising or streamlining work and procedures.	3.Resource Management	2.Team
42	Managements and supervisors take serious consideration about your job and your future.	3.Resource Management	2.Team
43	Job evaluation by management takes in consideration both positive and negative.	3.Resource Management	2.Team
44	Employee could be blamed after an incident caused by personal error or mistake.	6.Awareness	2.Team
45	The labelling, colour code, signs and hazard limits are consistent.	6.Awareness	2.Team
46	Equipment and installation were used passed their service life.	8.Work Management	2.Team
47	Management of change for equipment and procedures are clearly defined and implemented.	8.Work Management	2.Team
48	When implementing change, permission by expert supervisor is required.	8.Work Management	2.Team
49R	Work habits take priority over rules and regulations.	1.Governance	2.Team
50	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	2.Commitment	2.Team
51	In case of new installation or maintenance, review procedures are insufficiently organized.	2.Commitment	2.Team
52	Equipment is operated systematically above normal design conditions.	3.Resource Management	2.Team
53	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	6.Awareness	2.Team
54	There are systematic symbols/numbers labelled on the important components, such as valves/plumbing/pumps, and it coincides with the P & ID.	6.Awareness	2.Team

55	The important valves are labelled with tags (Open/ close/ do not operate).	6.Awareness	2.Team
56	Lockout / tag out procedures are used during work, and permission is granted by the shift supervisor.	6.Awareness	2.Team
57	The environmental conditions of the work area are in accordance with regulated occupational health standards.	6.Awareness	2.Team
58	There is a system in place to report, handle and revise noncompliance situation.	6.Awareness	2.Team
59	Process risk assessment method as HAZOP is used to assess risk of equipment / installations.	8.Work Management	2.Team
60	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	6.Awareness	2.Team
61	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	6.Awareness	2.Team
62	Accident and incidents records are organized in database and used for daily safety activities or training	6.Awareness	2.Team
63	My supervisor/management trusts my technical strengths/abilities.	4.Motivation	1.Individuals
64	I get satisfaction from my job.	4.Motivation	1.Individuals
65	Participating in symposiums/conventions/seminars related to safety is encouraged.	2.Commitment	1.Individuals
66	I actively participate in safety training.	2.Commitment	1.Individuals
67	I trust the sub-contractors technical competency.	7.Communication	1.Individuals
68	During preparation execution phase, supervisors/management gives me appropriate advice.	7.Communication	1.Individuals
69	I respect my supervisors/management because he/she have deep experience and effective skills.	7.Communication	1.Individuals
70	There are many unnecessary routine tasks that were not originally part of my responsibilities.	3.Resource Management	1.Individuals
71	Safety training and education are useful and efficient.	5.Learning	1.Individuals
72	Necessary manuals / diagrams / information are easily accessible.	8.Work Management	1.Individuals
73	I immediately take action to solve unclear situation during daily work.	8.Work Management	1.Individuals
74	I take priority to finish a task quickly rather than completing task using a safe and reliable method.	8.Work Management	1.Individuals

75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	8.Work Management	1.Individuals
76	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	1.Governance	1.Individuals
77	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	4.Motivation	1.Individuals
78	I actively participate in small group activities within my workplace.	2.Commitment	1.Individuals
79	I actively share beneficial information with everyone.	7.Communication	1.Individuals
80	There is a systematic training program to improve expertise on specific installation.	3.Resource Management	1.Individuals
81	I often visit on-site to find anomalies in equipment.	8.Work Management	1.Individuals
82	I always use standard operation procedures and checklists.	8.Work Management	1.Individuals
83	Standard operation procedures are well designed and easy to use.	8.Work Management	1.Individuals
84	There are opportunities for us to bypass safety rules under time pressure or non-essential rules.	8.Work Management	1.Individuals
85	I believe that professionals are able to perform even dangerous work.	8.Work Management	1.Individuals
86	All decision makes to satisfy company needs.	1.Governance	1.Individuals
87	Decisions made by the management always right.	7.Communication	1.Individuals
88	In case of concern or safety issues, budgets are always available.	1.Governance	3.Management
89	Issue related to on-site safety solved by each department and not reported to HSE department.	1.Governance	3.Management
90	Talented people are promoted in the HSE department.	1.Governance	3.Management
91	Our company has a system to develop HSE specialists.	1.Governance	3.Management
92	Important operational tasks are outsourced to sub-contractors.	1.Governance	3.Management
93	There is someone responsible to give advice about industrial safety laws and regulations.	1.Governance	3.Management
94	Employee can apply for new job or position through in-house staff recruitment system.	4.Motivation	3.Management
95	Senior experts considered and developed based on their experience and skills.	4.Motivation	3.Management
96	Coordination, collaboration and communication between departments are good.	7.Communication	3.Management

97	Safety practices and activities are shared internally and externally during meeting.	5.Learning	3.Management
98	Top management communicates and show that they put a high priority on safety.	1.Governance	3.Management
99	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	1.Governance	3.Management
100	The safety practices and action plans are discussed with employees.	1.Governance	3.Management
101	Safety performance (number of accidents/safety actions/safety budget) is communicated with workforce and used to revise next year plan.	1.Governance	3.Management
102	Top management visit workplace to communicates and share values on safety with employees.	2.Commitment	3.Management
103	Management communicate directly with employees about safety actions.	2.Commitment	3.Management
104	The salary structure corresponds to the quality and quantity of work.	3.Resource Management	3.Management
105	Headquarters auditors are also invited to perform safety audits based on standards.	1.Governance	3.Management
106	During safety audits, working conditions on workplace and safety concerns are grasped through questionnaire or interviews.	1.Governance	3.Management
107	The company has prepared some easy to use document to inform about safety rules and prohibited activities.	1.Governance	3.Management
108	I'm comfortable with my responsibilities.	1.Governance	3.Management
109	Company work satisfaction surveys are conducted and improvement measures are implemented based on feedback.	4.Motivation	3.Management
110	Downsizing or personnel job reduction have occurred at your company.	3.Resource Management	3.Management

Table 29: SDM SCAS Questionnaires related to 8 axes Model and 3 Sub-groups Relationship

8.2 ICSI SCAS Questionnaires

No	ICSI SCAS Questionnaires	Categorize
1	Loss of containment(oil spill, gas leak, blow-out,・・・)	Risk type questionnaires (answer sheet score only from 1 to 3)
2	Fire or explosion	
3	Exposure to hazardous substances(radioactivity, benzene, asbestos, others ・・・)	
4	transportation incident(marine, air, road)	
5	Lifting, handling or loading/unloading incident(falling/dropped object, lifting equipment incident, caught between ・・・)	
6	Fall from height(stairs, ladder, scaffold・・・)	
7	Minor work related injury(cut, burn, sprain, bruise,・・・)	
8	Major work related injury(amputation, electrical shock, fracture,・・・)	
9	Exposure to a dangerous situation caused by adverse weather conditions	
10	Collision by foreign vessels	Risk type Questionnaires.(answer sheet score only from 1 to 4)
11	Occupational Illness(back pain / lumbago, noise induced hearing loss, diseases due to vibration, dermatitis, musculoskeletal/repetitive strain injury・・・)	
12	Bad luck is the major cause of work related accidents.	
13R	Accidents at work may be avoided by applying personal experience rather than following written safety procedures.	
14	I have learned many things regarding safety at my job that I use in my private life out of work	
15	Most accidents at work happen to less experienced people.	
16	Following all the written safety rules or procedures in one's job is the best way to prevent accidents.	
17	Usually, I pay more attention to safety at work than in my private life.	
18	Most accidents at work result from a lack of compliance with written safety rules or procedures.	
19	Some accidents are unavoidable.	
20	I know and understand the HSE management system (HSE MS) put in place.	
21R	The work to be done requires that people act quickly.	
22	Interpersonal relations and communications between employees are good at this worksite.	Culture type Questionnaires
23	Interpersonal relations and communications between departments and trades	

	are good at this worksite.	
24	Access to equipment and tools (gauges, valves, panels, ladders) is easy.	
25R	Personnel worry about maintaining the required level of competencies due to the turnover and/or retirement of employees.	
26	Labor relations between middle management and employees are good at this worksite.	
27R	It may happen that the work be stressful.	
28	Investigations conducted following incidents identify the real causes of these events.	
29R	Some written safety rules are not essential to perform tasks safely.	
30R	Wrong design of certain equipment is the source of incidents and mistakes.	
31R	Housekeeping and storage is poor on this worksite.	Perception type Questionnaires
32	The HSE MS used is effective for controlling risks of severe accidents.	
33	Disciplinary action is taken in case of serious misconduct regarding safety.	
34	Safety of installations is adequate.	
35R	It may happen that installations are operated in a downgraded situation.	
36R	Some personnel shortages prevent employees doing the job safely.	
37	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	
38	Emergency drills are done seriously.	
39	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	
40	Safety requirements indicated on work permits are efficient.	
41	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	
42	The HSE Department advises realistic and efficient actions to prevent accidents.	
43	The HSE MS is effective for controlling risks of occupational illnesses.	
44R	Certain physical conditions (temperature, light, confined areas, space congestion, and noise) prevent employees doing the job safely.	
45	The work teams have a positive influence on the safety behavior of each one of the team members.	
46	The profitability objectives and production targets compromise safety	
47	The work permit process makes it possible to control the risks of the work to be done	

48R	It may happen that installations are operated with defective or inoperative safety systems.	
49	Management / supervisors put a higher priority on safety than on production.	
50	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	
51	Top management informs employees on various economic aspects of the company (future projects, challenges ...).	
52	Management / supervisors provide sufficient resources to employees to allow them to do their work safely.	
53	Supervisors react immediately if they observe an employee working unsafely.	
54R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	
55	Management / supervisors encourage employees to report all safety problems at work.	
56	Top management puts a very high priority on safety at work.	
57R	Management / supervisors put priority on safety only after an accident has occurred.	
58	Management / supervisors go to worksites to observe if tasks are performed safely.	
59	Management / supervisors act rapidly as soon as a safety concern is reported.	
60	Top management has credibility regarding safety at work because they practice what they preach.	
61	Management / supervisors remind employees about the importance of applying the safety rules.	
62	Management / supervisors take efficient actions to remedy the risk reported by the employees.	
63	Management reminds employees about unsafe behaviors that may be punishable through disciplinary action.	
64	Top management puts a higher priority on safety than occupational health risks	
65	Top management ensures that efficient controls for occupational health risks are implemented at the worksite.	
66	Top management puts a higher priority on safety rather than environmental risk	
67R	It is difficult for management / supervisors to combine safety with the other priorities.	

68	Top management strongly motivates all employees to consider safety a priority at work.
69	Top management puts in place efficient solutions to reduce the pollution rate of overboard water
70R	Some managers / supervisors tolerate dangerous practices at work.
71	During site visits, top management communicates in a constructive manner with employees.
72	The good safety performance of employees is recognized and acknowledged by their managers/ supervisors.
73	Employees are invited to recommend solutions when they report hazardous situations or safety problems.
74	Employees are consulted about changes concerning their work.
75R	Employees are concerned about the continuity of their employment related to TABK activities.
76	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.
77	Employees use incorrect postures to carry out their tasks.
78	Employees put safety as a priority in their work.
79R	Fear of being blamed discourages employees to report certain safety incidents.
80	Meetings make it possible for employees to contribute to solving safety issues.
81	Employees wear all personal protective equipment (PPE) required for the task
82	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.
83R	It may happen that some work pressures(rush, unexpected operations, backlog, urgent requests) push employees to bypass written safety rules and take risks
84R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.
85	Employees give advice to each other to work in a safe manner.
86	Some written safety rules applicable to routine tasks are bypassed by employees
87	Employees make suggestions to improve safety elements of their work.
88R	Safety systems on installations are bypassed by employees.
89	Employees are consulted for improving safety rules to be applied in their work.
90	Employees remind each other to comply with the safety rules and procedures applicable to their work.

91	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	
92	The long serving employees pass on their professional knowledge to the newcomers to train them.	
93	Employees are well informed and trained regarding job related environmental risks.	
94	Employees implement the rules and procedures set to protect the environment	
95	Employees apply the rules and procedures set for protecting their health at work.	
96	Employees are well informed and trained regarding job related health risks.	
97	Anomaly card system leads to real improvements.	
98	Employees receive feedback on the anomaly cards they submit.	
99	Employees are adequately informed regarding risks on site.	
100R	Employees are overconfident in their own abilities.	
101	HSE incentive programs encourage employees to work more safely.	
102	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	
103	Employees separate waste according to site rules.	

Table 30: ICSI SCAS Questionnaires and its Categorized

8.3 List of Table of SDM and ICSI Questions compare with Semantic and Correlation Analysis

					ICSI Judgement		SDM Judgement	
No	SDM Q	Shinoda No	ICSI Q	Spearman value	Same	Similar	Same	Similar
3	I do not hesitate to communicate about my concerns and request with colleague.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.406		✔		
23	Management participates in safety education and training with constructive manner.	170	Top management has credibility regarding safety at work because they practice what they preach.	0.409	✔		✔	
24	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	189R	Fear of being blamed discourages employees to report certain safety incidents.	0.369		✔		
29	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	150	Safety requirements indicated on work permits are efficient.	0.357				✔
49R	Work habits take priority over rules and regulations.	194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.357		✔		
53	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.371		✔		
56	Lockout / tagout procedures are used during work, and permission is granted by the shift supervisor.	150	Safety requirements indicated on work permits are efficient.	0.349		✔		✔
58	There is a system in place to report, handle and revise non compliance situation.	173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.358	✔			
60	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.374	✔		✔	
74R	I takes priority to finish a task quickly rather than completing task using a safe and reliable method.	194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.447		✔		
75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	0.359				✔
82	I always use standard operation procedures and checklists.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.416	✔			
		198R	Safety systems on installations are bypassed by employees.	0.373		✔		
		205	Employees apply the rules and procedures set for protecting their health at work.	0.341	✔			
83	Standard operation procedures are well designed and easy to use.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.357		✔		✔
98	Top management communicates and show that they puts a high priority on safety.	166	Top management puts a very high priority on safety at work.	0.436	✔		✔	

99	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.462				✔
3	I do not hesitate to communicate about my concerns and request with colleague.	132	Interpersonal relations and communications between employees are good at this worksite.	0.216	✔		✔	
4	Methods to communicate about opinion and concerns regarding safety to management of	160	Management / supervisors react positively to employees' ideas and suggestions to improve	0.237	✔		✔	
5	Interpersonal relations between employees are good at this worksite.	132	Interpersonal relations and communications between employees are good at this worksite.	0.258	✔		✔	
12	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our	147	The results of investigations on the causes of incidents are communicated and discussed with the workforce	0.129	✔		✔	
14	Rules and procedures are properly revised, understood and used .	139R	Some written safety rules are not essential to perform tasks safely.	0.299	✔		✔	
20	Special operation and modifications at the plant cannot be done without permission from the shift supervisor.	190	Safety requirements indicated on work permits are efficient.	0.238	✔		✔	
31	Good housekeeping / storage and work area organization is in place.	141R	Housekeeping and storage is poor on this worksite.	0.138	✔		✔	
38	Safety initiative are shared with entire workforce, and excellent actions are acknowledged.	182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.165	✔		✔	
44R	Employee could be blamed after an incident caused by personal error or mistake.	164R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	0.087	✔		✔	
46R	Equipment and installation were used passed their service life.	145R	It may happen that installations are operated in a downgraded situation.	0.137	✔		✔	
49R	Work habits take priority over rules and regulations.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.337	✔		✔	
50	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.269	✔		✔	
57	The environmental conditions of the work area are in accordance with regulated occupational health standards.	153	The HSE MS is effective for controlling risks of occupational illnesses.	0.25	✔		✔	
77	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors	0.161	✔		✔	
83	Standard operation procedures are well designed and easy to use.	139R	Some written safety rules are not essential to perform tasks safely.	0.32	✔		✔	
84R	There are opportunities for us to bypass safety rules under time pressure or non essential rules.	193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	0.127	✔		✔	
85R	I believe that professionals are able to perform even dangerous work.	210R	Employees are overconfident in their own abilities.	0.081	✔		✔	
88	In case of concern or safety issues, budget are always available.	162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.256	✔		✔	
96	Coordination, collaboration and communication between departments are good.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.296	✔		✔	
103	Management communicate directly with employees about safety actions.	171	Management / supervisors remind employees about the importance of applying the safety rules.	-0.261			✔	

Table 31: List of Common Question Pairs that support from Semantic and Correlation Data

					CSI Judgemen		DM Judgemen	
No	SDM Questions	Shinoda no	ICSI Questions	Spearman value	Same	Similar	Same	Similar
2	Teammates are highly motivated to work together focused on improvement.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.117		✔		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.27		✔		✔
		211	HSE incentive programs encourage employees to work more safely.	0.111		✔		
6	Employees are able to freely express their opinion regardless of their position or experience.	136	Labour relations between middle management and employees are good at this worksite.	0.092				✔
		183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.25		✔		
		184	Employees are consulted about changes concerning their work.	0.152		✔		
7	Supervisors / managers have good understanding of their employees jobs / responsibilities / progress.	168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.254				✔
8R	Some departments or individuals use too much overtimes to perform their jobs.	146R	Some personnel shortages prevent employees doing the job safely.	0.044		✔		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	-0.038		✔		
9	Sub-contractor employee receive sufficient training on the safety.	186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	0.156		✔		
		209	Employees are adequately informed regarding risks on site.	0.176		✔		
11	There are some formal and informal events that company and sub-contracting company employees can attend.	211	HSE incentive programs encourage employees to work more safely.	0.019		✔		
12	Experience and finding from incident which happened at other worksite / companies are also communicated and taken in consideration at our worksite.	199	Employees are consulted for improving safety rules and procedures to be applied in their work.	0.115				✔
13	During On the Job Training, safety is highly emphasized as very important.	171	Management / supervisors remind employees about the importance of applying the safety rules.	0.256	✔			
		178	Top management strongly motivates all employees to consider safety a priority at work.	0.152		✔		
		186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	0.116				✔
		199	Employees are consulted for improving safety rules and procedures to be applied in their work.	0.161				✔
		202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.175		✔		✔
15	In order to improve operational skills, one-on-one guidance is given by experienced co-workers.	195	Employees give advice to each other to work in a safe manner.	0.233		✔		
		200	Employees remind each other to comply with the safety rules and procedures applicable to their work.	0.133		✔		
		202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.234			✔	
16	Important technical skills must be listed, and program is in place to transmit this information without any omissions.	135	Personnel worry about maintaining the required level of competencies due to the turnover and/or retirement of employees.	0.026		✔		✔
		206	Employees are well informed and trained regarding job related health risks.	0.211		✔		

17	For planning maintenance shutdown, previous accomplishments are considered.	147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	0.102		✔		
19	Employees are open to changes and modification of organization and system.	184	Employees are consulted about changes concerning their work.	0.118		✔		✔
21	During discussion with management, employees have clear understanding of personnel evaluation and goals.	136	Labour relations between middle management and employees are good at this worksite.	0.044		✔		✔
21	During discussion with management, employees have clear understanding of personnel evaluation and goals.	181	During site visits, top management communicates in a constructive manner with employees.	0.164		✔		
22	Employees always work hard for continuous improvement.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.174		✔		✔
		197	Employees make suggestions to improve safety elements of their work.	0.227		✔		✔
23	Management participates in safety education and training with constructive manner.	178	Top management strongly motivates all employees to consider safety a priority at work.	0.205		✔		✔
24	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	0.141		✔		
		165	Management / supervisors encourage employees to report all safety problems at work.	0.311	✔			
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.283	✔			
25	People collaborate to help each other when work is unbalance between departments or employees.	195	Employees give advice to each other to work in a safe manner.	0.166	✔			
26R	There are too much useless or inefficient meetings.	190	Meetings make it possible for employees to contribute to solving safety issues.	0.191		✔	✔	
27R	There is an age imbalance in the composition of the employees and the transition of technical skills cannot be completed smoothly.	202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.06	✔			✔
28	Technical information is shared between maintenance department and operations department.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.199		✔		✔
29	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	149	The risks mitigation measures implemented in case of downgraded situation are effective for	0.318				✔
		154R	Certain physical conditions (temperature, light, confined areas, space congestion, and noise) do not allow the employees to do their work properly.	0.159	✔			
		175	Top management ensures that efficient controls for occupational health risks are implemented at the worksite.	-0.138		✔		
		209	Employees are adequately informed regarding risks on site.	0.206				✔
30	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	148	Emergency drills are done seriously.	0.289		✔		
32	Hazardous areas and operational hazards are properly labeled to make people aware.	209	Employees are adequately informed regarding risks on site.	0.264		✔		
		206	Employees are well informed and trained regarding job related health risks.	0.299		✔		
34	Experience related to past accidents, incidents and human behaviors are taken in consideration in work standards and procedures.	147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	0.063		✔		✔
35	There are systematic skill training programs available which people can attend based on their skill level.	186	Employees arriving on a new position receive sufficient training on the safety aspects of their	0.134		✔		
		203	Employees are well informed and trained regarding job related environmental risks.	0.278		✔		
		206	Employees are well informed and trained regarding job related health risks.	0.261	✔			

36	Good conditions of equipment (such as the pumps) is continually inspected, and any abnormalities are reported.	144	Safety of installations is adequate.	-0.042		✔		
37	Initiative and attitudes for safety actions are promoted and included in the personnel evaluations.	182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.26		✔	✔	
38	Safety initiative are shared with entire workforce, and excellent actions are acknowledged.	166	Top management puts a very high priority on safety at work.	0.205		✔		
		178	Top management strongly motivates all employees to consider safety a priority at work.	-0.08		✔		
40R	Non real information and rumors are incorrectly reported.	165	Management / supervisors encourage employees to report all safety problems at work.	0.296				✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.308		✔		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.244		✔		✔
41	Managers and employees try to reduce amount of work by revising or streamlining work and procedures.	146R	Some personnel shortages prevent employees doing the job safely.	0.195		✔		
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.295		✔		
43	Job evaluation by management takes in consideration both positive and negative.	143	Disciplinary action is taken in case of serious	0.2		✔		
		182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.225		✔		
46R	Equipment and installation were used passed their service life.	144	Safety of installations is adequate.	0.037		✔		
47	Management of change for equipment and procedures are clearly defined and implemented.	153	The HSE MS is effective for controlling risks of occupational illnesses.	0.247		✔		
48	When implementing change, permission by expert supervisor is required.	150	Safety requirements indicated on work permits are efficient.	0.313	✔			✔
49R	Work habits take priority over rules and regulations.	193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	0.246		✔		
50	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	0.198		✔		✔
		197	Employees make suggestions to improve safety elements of their work.	0.257	✔			
		199	Employees are consulted for improving safety rules and procedures to be applied in their work.	0.148	✔			✔
54	There are systematic symbols/numbers labeled on the important components, such as valves/plumbing/pumps, and it coincides with the P & ID.	142	The HSE MS is effective for controlling risks of severe accidents.	-0.032		✔		
		154R	Certain physical conditions (temperature, light, confined areas, space congestion, and noise) do not allow the employees to do their work properly.	0.252			✔	
59	Process risk assessment method as HAZOP is used to assess risk of equipment / installations.	142	The HSE MS used is effective for controlling risks of severe accidents.	-0.111		✔		
60	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	165	Management / supervisors encourage employees to report all safety problems at work.	0.269		✔		✔
61	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	142	The HSE MS is effective for controlling risks of severe accidents.	-0.008		✔		
		150	Safety requirements indicated on work permits are efficient.	0.317		✔		
62	Accident and incidents records are organized in database and used for daily safety activities or training	138	Investigations conducted following incidents identify the real causes of these events.	-0.031		✔		
		147	The results of investigations on the causes of incidents are communicated and discussed with the workforce.	0.079	✔			
66	I actively participate in safety training.	209	Employees are adequately informed regarding risks on site.	0.333		✔		✔
		188	Employees put safety as a priority in their work.	0.221		✔		✔
68	During preparation execution phase, supervisors/management give me appropriate advice.	150	Safety requirements indicated on work permits are efficient.	0.307		✔		
		209	Employees are adequately informed regarding risks on site.	0.294		✔		

69	I respect my supervisors/management because he/she have deep experience and effective skills.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.107		✔		
		195	Employees give advice to each other to work in a safe manner.	0.229		✔		
		202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.271		✔		
71	Safety training and education are useful and efficient.	148	Emergency drills are done seriously.	0.301				✔
		186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	0.195		✔		
		209	Employees are adequately informed regarding risks on site.	0.275		✔		
		203	Employees are well informed and trained regarding job related environmental risks.	0.33		✔		
		206	Employees are well informed and trained regarding job related health risks.	0.343		✔		
73	I immediately take action to solve unclear situation during daily work.	169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.187		✔		
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.304		✔		
74R	I takes priority to finish a task quickly rather than completing task using a safe and reliable method.	-	-	0.196		✔		
		146R	Some personnel shortages prevent employees doing the job safely.	0.282		✔		
		159	Management / supervisors put a higher priority on safety than on production.	0.275	✔			
		162	Management provides sufficient resources to employees to allow them to do their work safely.	0.198		✔		
		166	Top management puts a very high priority on safety at work.	0.277		✔		
		177R	It is difficult for management / supervisors to combine safety with the other priorities.	-0.195		✔		
		193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	0.242			✔	
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.331				✔
		198R	Safety systems on installations are bypassed by employees.	0.262		✔		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.268		✔		
75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	188	Employees put safety as a priority in their work.	0.132		✔		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.209		✔		
76	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	159	Management / supervisors put a higher priority on safety than on production.	0.157		✔	✔	
		205	Employees put safety as a priority in their work.	0.014		✔		
		194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.128			✔	
77	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	211	HSE incentive programs encourage employees to work more safely.	0.028		✔		✔
78	I actively participate in small group activities within my workplace.	183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.238		✔		
		184	Employees are consulted about changes concerning their work.	0.176		✔		
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.242		✔		
		199	Employees are consulted for improving safety rules to be applied in their work.	0.03		✔		
79	I actively share beneficial information with everyone.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.127		✔		
		195	Employees give advice to each other to work in a safe manner.	0.243		✔		
		197	Employees make suggestions to improve safety elements of their work.	0.282		✔		
		200	Employees remind each other to comply with the safety rules and procedures applicable to their work.	0.256		✔		

69	I respect my supervisors/management because he/she have deep experience and effective skills.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.107		✔		
		195	Employees give advice to each other to work in a safe manner.	0.229		✔		
		202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.271		✔		
71	Safety training and education are useful and efficient.	148	Emergency drills are done seriously.	0.301				✔
		186	Employees arriving on a new position receive sufficient training on the safety aspects of their work before working on their own.	0.195		✔		
		209	Employees are adequately informed regarding risks on site.	0.275		✔		
		203	Employees are well informed and trained regarding job related environmental risks.	0.33		✔		
		206	Employees are well informed and trained regarding job related health risks.	0.343		✔		
73	I immediately take action to solve unclear situation during daily work.	169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.187		✔		
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.304		✔		
74R	I takes priority to finish a task quickly rather than completing task using a safe and reliable method.	-	-	0.196		✔		
		146R	Some personnel shortages prevent employees doing the job safely.	0.282		✔		
		159	Management / supervisors put a higher priority on safety than on production.	0.275	✔			
		162	Management provides sufficient resources to employees to allow them to do their work safely.	0.198		✔		
		166	Top management puts a very high priority on safety at work.	0.277		✔		
		177R	It is difficult for management / supervisors to combine safety with the other priorities.	-0.195		✔		
		193R	It may happen that some work pressures (rush, unexpected operations, backlog, urgent requests) push employees to bypass written safety rules and take risks	0.242			✔	
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.331				✔
		198R	Safety systems on installations are bypassed by employees.	0.262		✔		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.268		✔		
75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	188	Employees put safety as a priority in their work.	0.132		✔		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.209		✔		
76	I don't want to follow instruction of supervisors / management who set more priority on production than safety.	159	Management / supervisors put a higher priority on safety than on production.	0.157		✔	✔	
		205	Employees put safety as a priority in their work.	0.014		✔		
		194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.128			✔	
77	I am often recognized and acknowledged for good accomplishments and prioritizing safety.	211	HSE incentive programs encourage employees to work more safely.	0.028		✔		✔
78	I actively participate in small group activities within my workplace.	183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.238		✔		
		184	Employees are consulted about changes concerning their work.	0.176		✔		
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.242		✔		
		199	Employees are consulted for improving safety rules to be applied in their work.	0.03		✔		
79	I actively share beneficial information with everyone.	155	The work teams have a positive influence on the safety behaviour of each one of the team members.	0.127		✔		
		195	Employees give advice to each other to work in a safe manner.	0.243		✔		
		197	Employees make suggestions to improve safety elements of their work.	0.282		✔		
		200	Employees remind each other to comply with the safety rules and procedures applicable to their work.	0.256		✔		

81	I often visit on-site to find anomalies in equipment.	165	Management / supervisors encourage employees to report all safety problems at work.	0.164		✔		
		183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.189		✔		
82	I always use standard operation procedures and checklists.	194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.311		✔		✔
84R	There are opportunities for us to bypass safety rules under time pressure or non essential rules.	188	Employees put safety as a priority in their work.	0.165		✔		
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.159				✔
88	In case of concern or safety issues, budget are always available.	166	Top management puts a very high priority on safety at work.	0.299		✔		
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.314		✔		
		177R	It is difficult for management / supervisors to combine safety with the other priorities.	-0.149		✔		
89R	Issue related to on-site safety solved by each department and not reported to HSE department.	165	Management / supervisors encourage employees to report all safety problems at work.	0.273				✔
		169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.261		✔		
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.243		✔		
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.248			✔	
92R	Important operational tasks are outsourced to a sub-contractors.	146R	Some personnel shortages prevent employees doing the job safely.	0.12		✔		
93	There is a someone responsible to give advice about industrial safety laws and regulations.	199	Employees are consulted for improving safety rules to be applied in their work.	0.151				✔
94	Employee can apply for new job or position through in-house staff recruitment system.	161	Top management informs employees on various economical aspects of the company (future	0.274		✔		
		184	Employees are consulted about changes concerning their work.	0.131		✔		
97	Safety practices and activities are shared internally and externally during meeting.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.214				✔
		160	Management / supervisors react positively to employees' ideas and suggestions to improve	0.291		✔		
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.243	✔			
98	Top management communicates and show that they puts a high priority on safety.	178	Top management strongly motivates all employees to consider safety a priority at work.	0.246			✔	
99	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	175	Top management ensures that efficient controls for occupational health risks are implemented at the worksite.	-0.224		✔		
100	The safety practices and action plans are discussed with employees.	160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	0.334		✔		
		183	Employees are invited to recommend solutions when they report hazardous situations or safety problems.	0.32				✔
		184	Employees are consulted about changes concerning their work.	0.225		✔		
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.309				✔
		199	Employees are consulted for improving safety rules to be applied in their work.	0.203		✔		
102	Top management visit workplace to communicates and share values on safety with employees.	181	During site visits, top management communicates in a constructive manner with employees.	0.287		✔		✔
102	Top management visit workplace to communicates and share values on safety with employees.	168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.258				✔
103	Management communicate directly with employees about safety actions.	168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.244	✔			✔
		181	During site visits, top management communicates in a constructive manner with employees.	0.225		✔	✔	
105	Headquarters auditors are also invited to perform safety audits based on standards.	152	The HSE Department advises realistic and efficient actions to prevent accidents.	0.14		✔		✔
		153	The HSE MS is effective for controlling risks of occupational illnesses.	0.237		✔		
110R	Downsizing or personnel job reduction have occurred at your company.	135	Personnel worry about maintaining the required level of competencies due to the turnover and/or retirement of employees.	0.167		✔		
		146R	Some personnel shortages prevent employees doing the job safely.	0.112		✔		
		184	Employees are consulted about changes concerning their work.	0.055				✔

Table 32: List of Questions Pairs that support by Semantic Analysis but Weak in Correlation Analysis

					Expert Judge	
No	SDM Questions	Shinoda No	ICSI Questions	Spearman value	Same	No relation
3	I do not hesitate to communicate about my concerns and request with colleague.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.406		✔
		134	Access to equipment and tools (gauges, valves, panels, ladders) is easy.	0.357		✔
		137	It may happen that the work be stressful.	0.44		✔
4	Methods to communicate about opinion and concerns regarding safety to management of worksite are provided.	161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.386		✔
5	Interpersonal relations between employees are good at this worksite.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.585		✔
		134	Access to equipment and tools (gauges, valves, panels, ladders) is easy.	0.459		✔
		137	It may happen that the work be stressful.	0.455		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.376		✔
6	Employees are able to freely express their opinion regardless of their position or experience.	137	It may happen that the work be stressful.	0.416		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.35		✔
7	Supervisors / managers have good understanding of their employees jobs / responsibilities / progress.	137	It may happen that the work be stressful.	0.386		✔
13	During On the Job Training, safety is highly emphasized as very important.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.357		✔
14	Rules and procedures are properly revised, understood and used .	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.353		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.351		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.369		✔
15	In order to improve operational skills, one-on-one guidance is given by experienced co-workers.	203	Employees are well informed and trained regarding job related environmental risks.	0.402		✔
17	For planning maintenance shutdown, previous accomplishments are considered.	161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.359		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.367		✔
		203	Employees are well informed and trained regarding job related environmental risks.	0.375		✔
		207	Anomaly card system leads to real improvements.	0.372		✔
18R	Role and responsibilities are ambiguous within the workplace.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.381		✔
21	During discussion with management, employees have clear understanding of personnel evaluation and goals.	137	It may happen that the work be stressful.	0.371		✔
23	Management participates in safety education and training with constructive manner.	137	It may happen that the work be stressful.	0.353		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.425		✔
		166	Top management puts a very high priority on safety at work.	0.414		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.361		✔
		169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.381		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.409		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.433		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.384		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.377		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.358		✔
		182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.394		✔

24	Incidents and accidents are promptly reported to authorities, company headquarter and other worksites.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.35		✔
		166	Top management puts a very high priority on safety at work.	0.36		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.408		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.383		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.356		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.367		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.369		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.354		✔
29	Dangerous situations (work at height / lack of oxygen/toxic substances/high-temperature environments) are assessed, and counter-measures and barrier are implemented beforehand.	150	Safety requirements indicated on work permits are efficient.	0.357		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.359		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.356		✔
		189	Fear of being blamed discourages employees to report certain safety incidents.	0.374		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.351		✔
30	Emergency response system (Natural disasters and accidents) has been established, and drills are performed periodically.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.36		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.35		✔
31	Good housekeeping / storage and work area organization is in place.	142	The HSE MS used is effective for controlling risks of severe accidents.	0.427		
33	Best safety measures and practices from other plants/other companies are introduced and implemented.	148	Emergency drills are done seriously.	0.395		✔
34	Experience related to past accidents, incidents and human behaviors are taken in consideration in work standards and procedures.	179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.361		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.366		✔
39	Any concerns and/or requests from the sub-contractors are reported to the company management and are promptly taken care	137	It may happen that the work be stressful.	0.376		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.385		✔
40R	Non real information and rumors are incorrectly reported.	171	Management / supervisors remind employees about the importance of applying the safety rules.	0.378		✔
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.381		✔
		194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.357		✔
		197	Employees make suggestions to improve safety elements of their work.	0.361		✔
41	Managers and employees try to reduce amount of work by revising or streamlining work and procedures.	198R	Safety systems on installations are bypassed by employees.	0.35		✔
42	Managements and supervisors take serious consideration about your job and your future.	137	It may happen that the work be stressful.	0.363		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.413		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.384		✔
47	Management of change for equipment and procedures are clearly defined and implemented.	150	Safety requirements indicated on work permits are efficient.	0.376		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.358		✔
		159	Management / supervisors put a higher priority on safety than on production.	0.355		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.361		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.374		✔
		189	Fear of being blamed discourages employees to report certain safety incidents.	0.365		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.365		✔
		204	Employees implement the rules and procedures set to protect the environment	0.391		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.396		✔
		206	Employees are well informed and trained regarding job related health risks.	0.379		✔
		207	Anomaly card system leads to real improvements.	0.401		✔
49R	Work habits take priority over rules and regulations.	194	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.357		✔

50	Employees' opinions are taken in consideration for revision of actions/measures to improve safety.	139R	Some written safety rules are not essential to perform tasks safely.	0.4		✔
		153	The HSE MS is effective for controlling risks of occupational illnesses.	0.376		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.392		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.359		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.357		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.388		✔
		176	Top management puts a higher priority on safety rather than environmental risk	0.372		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.353		✔
		210R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.367		✔
51R	In case of new installation or maintenance, review procedures are insufficiently organized.	171	Management / supervisors remind employees about the importance of applying the safety rules.	0.402		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.385		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.363		✔
52R	Equipment are operated systematically above normal design conditions.	189R	Fear of being blamed discourages employees to report certain safety incidents.	0.387		✔
		181	During site visits, top management communicates in a constructive manner with employees.	0.363		✔
		197	Employees make suggestions to improve safety elements of their work.	0.359		✔
53	Before non-routine tasks are performed, risk assessment and barriers are reviewed.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.371		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.372		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.352		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.38		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.371		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.359		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.368		✔
57	The environmental conditions of the work area are in accordance with regulated occupational health standards.	161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.352		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.369		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.385		✔
		207	Anomaly card system leads to real improvements.	0.365		✔
58	There is a system in place to report, handle and revise non compliance situation.	173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.358		✔
		207	Anomaly card system leads to real improvements.	0.354		✔
59	Process risk assessment method as HAZOP is used to assess risk of equipment / installations.	131R	The work to be done requires that people act quickly.	0.36		✔
60	Even near-misses that could lead to the possibility of work-related injuries/ equipment accidents/ incidents (accident/malfunction) are reported and dealt with.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.366		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.38		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.357		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.366		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.357		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.37		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.374		✔
		206	Employees are well informed and trained regarding job related health risks.	0.356		✔
		207	Anomaly card system leads to real improvements.	0.369		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.402		✔
		210R	Employees are overconfident in their own abilities.	0.363		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.376		✔

61	Technical experts, management and HSE department must assess and agree on change or replacement of new or important equipment / installation.	161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.369		✔
		166	Top management puts a very high priority on safety at work.	0.353		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.425		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.374		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.35		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.405		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.38		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.379		✔
		206	Employees are well informed and trained regarding job related health risks.	0.37		✔
		207	Anomaly card system leads to real improvements.	0.363		✔
62	Accident and incidents records are organized in database and used for daily safety activities or training	148	Emergency drills are done seriously.	0.392		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.356		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.387		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.364		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.357		✔
		206	Employees are well informed and trained regarding job related health risks.	0.355		✔
		207	Anomaly card system leads to real improvements.	0.379		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.398		✔
63	My supervisor/management trust my technical strengths/abilities.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.356		✔
		137	It may happen that the work be stressful.	0.4		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.384		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.359		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.369		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.369		✔
64	I get satisfaction from my job.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.391		✔
		134	Access to equipment and tools (gauges, valves, panels, ladders) is easy.	0.377		✔
		137	It may happen that the work be stressful.	0.391		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.357		
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.365		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.366		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.388		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.355		✔
66	I actively participate in safety training.	151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.357		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.377		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.353		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.363		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.393		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.362		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.42		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.362		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.368		✔
		207	Anomaly card system leads to real improvements.	0.375		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.352		✔

68	During preparation execution phase, supervisors/management give me appropriate advice.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.382		✔
		137	It may happen that the work be stressful.	0.415		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.439		✔
		164R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	0.401		✔
		165	Management / supervisors encourage employees to report all safety problems at work.	0.386		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.378		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.391		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.401		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.416		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.367		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.355		✔
		203	Employees are well informed and trained regarding job related environmental risks.	0.382		✔
		210R	Employees are overconfident in their own abilities.	0.357		✔
69	I respect my supervisors/management because he/she have deep experience and effective skills.	133	Interpersonal relations and communications between departments and trades are good at this worksite.	0.385		✔
		137	It may happen that the work be stressful.	0.394		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.426		✔
		164R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	0.4		✔
		165	Management / supervisors encourage employees to report all safety problems at work.	0.427		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.365		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.393		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.4		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.357		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.358		✔
71	Safety training and education are useful and efficient.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.406		✔
		150	Safety requirements indicated on work permits are efficient.	0.36		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.356		✔
		169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.379		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.406		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.392		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.383		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.363		✔
		191	Employees wear all personal protective equipment (PPE) required for the task	0.365		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.362		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.375		✔
		204	Employees implement the rules and procedures set to protect the environment	0.357		✔
		207	Anomaly card system leads to real improvements.	0.406		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.367		✔
74R	I takes priority to finish a task quickly rather than completing task using a safe and reliable method.	194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.447		✔
		195	Employees give advice to each other to work in a safe manner.	0.351		✔
75	When I face unsafe situation during my work, I choose more safe method even if it means stopping the job.	193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks	0.356		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.379		
79	I actively share beneficial information with everyone.	137	It may happen that the work be stressful.	0.352		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.39		✔
82	I always use standard operation procedures and checklists.	149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.377		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.359		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.379		✔
		192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	0.369		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.416		✔
		197	Employees make suggestions to improve safety elements of their work.	0.357		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.392		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.373		✔
		206	Employees are well informed and trained regarding job related health risks.	0.372		✔

83	Standard operation procedures are well designed and easy to use.	196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.357		✔
93	There is a someone responsible to give advice about industrial safety laws and regulations.	171	Management / supervisors remind employees about the importance of applying the safety rules.	0.378		✔
97	Safety practices and activities are shared internally and externally during meeting.	148	Emergency drills are done seriously.	0.374		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.366		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.376		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.382		✔
		168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.445		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.377		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.381		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.38		✔
		176	Top management puts a higher priority on safety rather than environmental risk	0.352		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.356		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.404		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.359		✔
		207	Anomaly card system leads to real improvements.	0.353		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.393		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.37		✔
98	Top management communicates and show that they puts a high priority on safety.	139R	Some written safety rules are not essential to perform tasks safely.	0.4		✔
		143	Disciplinary action is taken in case of serious misconduct regarding safety.	0.396		✔
		145R	It may happen that installations are operated in a downgraded situation.	0.396		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.409		✔
		157	The work permit process makes it possible to control the risks of the work to be done	0.384		✔
		159	Management / supervisors put a higher priority on safety than on production.	0.365		✔
		160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	0.404		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.416		✔
		166	Top management puts a very high priority on safety at work.	0.436		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.551		✔
		168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.371		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.409		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.407		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.457		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.403		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.503		✔
		181	During site visits, top management communicates in a constructive manner with employees.	0.4		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.433		✔
		192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	0.385		✔
		193R	It may happen that some work pressures(rush,unexpected operations,backlog,urgent requests) push employees to bypass written safety rules and take risks.	0.365		✔
		194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.356		✔
		195	Employees give advice to each other to work in a safe manner.	0.443		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.457		✔
		197	Employees make suggestions to improve safety elements of their work.	0.444		✔
		198R	Safety systems on installations are bypassed by employees.	0.371		✔
		204	Employees implement the rules and procedures set to protect the environment	0.352		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.439		✔
		206	Employees are well informed and trained regarding job related health risks.	0.418		✔
		207	Anomaly card system leads to real improvements.	0.414		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.36		✔
		210R	Employees are overconfident in their own abilities.	0.369		✔
		213	Employees separate waste according to site rules.	0.357		✔

99	Concrete action plans and practices are planned and implemented based on safety policy set by top management.	137	It may happen that the work be stressful.	0.371		✔
		139R	Some written safety rules are not essential to perform tasks safely.	0.41		✔
		143	Disciplinary action is taken in case of serious misconduct regarding safety.	0.41		✔
		145R	It may happen that installations are operated in a downgraded situation.	0.388		✔
		149	The risks mitigation measures implemented in case of downgraded situation are effective for controlling the risks.	0.384		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.419		✔
		156R	The profitability objectives and production targets compromise safety	0.357		✔
		157	The work permit process makes it possible to control the risks of the work to be done	0.36		✔
		160	Management / supervisors react positively to employees' ideas and suggestions to improve safety at work.	0.379		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.437		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.359		✔
		163	Supervisors react immediately if they observe an employee working unsafely.	0.368		✔
		164R	After an incident, it may happen that management / supervisors attribute the cause to an employee.	0.352		✔
		166	Top management puts a very high priority on safety at work.	0.419		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.478		✔
		168	Management / supervisors goes to worksites to observe if tasks are performed safely.	0.367		✔
		169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.364		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.446		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.445		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.462		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.453		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.48		✔
		181	During site visits, top management communicates in a constructive manner with employees.	0.378		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.447		✔
		190	Meetings make it possible for employees to contribute to solving safety issues.	0.354		✔
		192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	0.356		✔
		194R	The production targets (linked to the gas nomination) encourage employees to bypass the rules or safety systems.	0.408		✔
		195	Employees give advice to each other to work in a safe manner.	0.42		✔
		196	Some written safety rules applicable to routine tasks are bypassed by employees	0.496		
		197	Employees make suggestions to improve safety elements of their work.	0.407		✔
		198R	Safety systems on installations are bypassed by employees.	0.406		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.431		✔
		203	Employees are well informed and trained regarding job related environmental risks.	0.351		✔
		204	Employees implement the rules and procedures set to protect the environment	0.421		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.51		✔
		206	Employees are well informed and trained regarding job related health risks.	0.482		✔
		207	Anomaly card system leads to real improvements.	0.448		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.415		✔
		210R	Employees are overconfident in their own abilities.	0.406		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.434		✔
		213	Employees separate waste according to site rules.	0.369		✔
100	The safety practices and action plans are discussed with employees.	151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.362		✔
		156R	The profitability objectives and production targets compromise safety	0.353		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.404		✔
		166	Top management puts a very high priority on safety at work.	0.361		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.387		✔
		170	Top management has credibility regarding safety at work because they practice what they preach.	0.407		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.391		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.412		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.461		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.399		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.419		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.412		✔
		198R	Safety systems on installations are bypassed by employees.	0.378		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.382		✔
		204	Employees implement the rules and procedures set to protect the environment	0.383		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.392		✔
		206	Employees are well informed and trained regarding job related health risks.	0.393		✔
		207	Anomaly card system leads to real improvements.	0.386		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.361		✔
		212	Employees can stop a job if an unsafe action or condition is observed without getting in trouble.	0.363		✔

101	Safety performance (number of accidents/safety actions/safety budget) is communicated with workforce and used to revise next year plan.	148	Emergency drills are done seriously.	0.372		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.352		✔
		166	Top management puts a very high priority on safety at work.	0.367		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.391		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.38		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.361		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.365		✔
		189R	Fear of being blamed discourages employees to report certain safety incidents.	0.354		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.368		✔
		201R	It may happen that some reportable incidents that may have hurt someone have not been reported by employees.	0.362		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.398		✔
		207	Anomaly card system leads to real improvements.	0.402		✔
		208	Employees receive feedback on the anomaly cards they submit.	0.385		✔
102	Top management visit workplace to communicates and share values on safety with employees.	143	Disciplinary action is taken in case of serious misconduct regarding safety.	0.383		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.352		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.381		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.409		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.404		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.448		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.397		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.387		✔
		176	Top management puts a higher priority on safety rather than environmental risk	0.422		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.409		✔
		182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.423		✔
		196R	Some written safety rules applicable to routine tasks are bypassed by employees	0.351		✔
		198R	Safety systems on installations are bypassed by employees.	0.37		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.377		✔
		206	Employees are well informed and trained regarding job related health risks.	0.398		✔
		207	Anomaly card system leads to real improvements.	0.419		✔
		210R	Employees are overconfident in their own abilities.	0.358		✔
		213	Employees separate waste according to site rules.	0.352		✔
103	Management communicate directly with employees about safety actions.	137	It may happen that the work be stressful.	0.353		✔
		153	The HSE MS is effective for controlling risks of occupational illnesses.	0.369		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.403		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.402		✔
		163	Supervisors react immediately if they observe an employee working unsafely.	0.355		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.369		✔
		169	Management / supervisors act rapidly as soon as a safety concern is reported.	0.366		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.473	✔	
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.382		✔
		173	Management reminds employees about unsafe behaviours that may be punishable through disciplinary action.	0.408		✔
		176	Top management puts a higher priority on safety rather than environmental risk	0.381		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.384		✔
		182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.496		✔
		207	Anomaly card system leads to real improvements.	0.381		✔
		210R	Employees are overconfident in their own abilities.	0.361		✔

104	The salary structure corresponds to the quality and quantity of work.	137	It may happen that the work be stressful.	0.374		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.366		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.41		✔
105	Headquarters auditors are also invited to perform safety audits based on standards.	131R	The work to be done requires that people act quickly.	0.471		✔
		143	Disciplinary action is taken in case of serious misconduct regarding safety.	0.382		✔
		151	Work teams put pressure on their supervisors to obtain corrective measures for some dangerous situations.	0.382		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.389		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.361		✔
		167	Management / supervisors put priority on safety only after an accident has occurred.	0.411		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.409		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.385		✔
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.425		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.439		✔
		206	Employees are well informed and trained regarding job related health risks.	0.416		✔
		207	Anomaly card system leads to real improvements.	0.432		✔
106	During safety audits, working conditions on workplace and safety concerns are grasped through questionnaire or interviews.	153	The HSE MS is effective for controlling risks of occupational illnesses.	0.354		✔
		154R	Certain physical conditions (temperature, light, confined areas, space congestion, and noise) prevent employees doing the job safely.	0.352		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.387		✔
		162	Management / supervisors provides sufficient resources to employees to allow them to do their work safely.	0.377		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.401		✔
		182	The good safety performance of employees is recognised and acknowledged by their managers/ supervisors.	0.38		✔
		204	Employees implement the rules and procedures set to protect the environment	0.378		✔
		202	The long serving employees pass on their professional knowledge to the newcomers to train them.	0.377		✔
107	The company has prepared some easy to use document to inform about safety rules and prohibited activities.	167	Management / supervisors put priority on safety only after an accident has occurred.	0.385		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.4		
		179	Top management puts in place efficient solutions to reduce the pollution rate of overboard water	0.362		✔
		181	During site visits, top management communicates in a constructive manner with employees.	0.352		✔
		192	It may happen that a worker will intervene and stop a dangerous practice by a fellow worker.	0.392		✔
		197	Employees make suggestions to improve safety elements of their work.	0.351		✔
		205	Employees apply the rules and procedures set for protecting their health at work.	0.355		✔
108	I'm comfortable with my responsibilities.	131R	The work to be done requires that people act quickly.	0.352		✔
		137	It may happen that the work be stressful.	0.37		✔
		161	Top management informs employees on various economical aspects of the company (future projects, challenges ...).	0.393		✔
		171	Management / supervisors remind employees about the importance of applying the safety rules.	0.396		✔
		172	Management / supervisors take efficient actions to remedy the risk reported by the employees.	0.367		✔

Table 33: List of Question Pairs that Weak in Semantic Analysis but support by Correlation Analysis

安全文化システム構築のための
アンケート調査

良い例	●
悪い例	∅ ⊙ ▮

記入方法

1．記入は必ず **HBの黒鉛筆** で、〇の中を正確にぬりつぶして下さい。

2．訂正する場合は、消しゴムできれいに消して下さい。解答用紙を汚したり、折り曲げたりしないで下さい。

性別		
	男	①
	女	②

年齢		
	20歳以下	①
	21～30歳	②
	31～40歳	③
	41～50歳	④
	51～60歳	⑤
	61歳以上	⑥

勤続年数		
	3年以下	①
	4～10年	②
	11～20年	③
	21～30年	④
	31～40年	⑤
	41歳以上	⑥

勤務体系		
	主に直勤務	①
	主に日勤	②
	臨時・不定期	③

所属		
	（製造）生産・運転	①
	（保全）設備・検査・公務	②
	安全・環境	③
	ユーティリティ	④
	技術	⑤
	品質保証	⑥
	その他管理	⑦

主な職務		
	現場操作	①
	中央操作	②
	現場作業	③
	保守業務	④
	管理業務	⑤
	現場監督	⑥
	安全・環境業務	⑦
	（その他）技術一般	⑧

職位		
	課長クラス	①
	係長クラス	②
	主任・班長・リーダークラス	③
	スタッフ職	④
	一般職	⑤
	その他	⑥

1	① ② ③ ④ ⑤	26	① ② ③ ④ ⑤	51	① ② ③ ④ ⑤	71	① ② ③ ④ ⑤	**91**	① ② ③ ④ ⑤
2	① ② ③ ④ ⑤	27	① ② ③ ④ ⑤	52	① ② ③ ④ ⑤	72	① ② ③ ④ ⑤	**92**	① ② ③ ④ ⑤
3	① ② ③ ④ ⑤	28	① ② ③ ④ ⑤	53	① ② ③ ④ ⑤	73	① ② ③ ④ ⑤	**93**	① ② ③ ④ ⑤
4	① ② ③ ④ ⑤	29	① ② ③ ④ ⑤	54	① ② ③ ④ ⑤	74	① ② ③ ④ ⑤	**94**	① ② ③ ④ ⑤
5	① ② ③ ④ ⑤	30	① ② ③ ④ ⑤	55	① ② ③ ④ ⑤	75	① ② ③ ④ ⑤	**95**	① ② ③ ④ ⑤
6	① ② ③ ④ ⑤	31	① ② ③ ④ ⑤	56	① ② ③ ④ ⑤	76	① ② ③ ④ ⑤	96	① ② ③ ④ ⑤
7	① ② ③ ④ ⑤	32	① ② ③ ④ ⑤	57	① ② ③ ④ ⑤	77	① ② ③ ④ ⑤	97	① ② ③ ④ ⑤
8	① ② ③ ④ ⑤	33	① ② ③ ④ ⑤	58	① ② ③ ④ ⑤	78	① ② ③ ④ ⑤	98	① ② ③ ④ ⑤
9	① ② ③ ④ ⑤	34	① ② ③ ④ ⑤	59	① ② ③ ④ ⑤	79	① ② ③ ④ ⑤	99	① ② ③ ④ ⑤
10	① ② ③ ④ ⑤	35	① ② ③ ④ ⑤	60	① ② ③ ④ ⑤	80	① ② ③ ④ ⑤	100	① ② ③ ④ ⑤
11	① ② ③ ④ ⑤	36	① ② ③ ④ ⑤	61	① ② ③ ④ ⑤	81	① ② ③ ④ ⑤	101	① ② ③ ④ ⑤
12	① ② ③ ④ ⑤	37	① ② ③ ④ ⑤	62	① ② ③ ④ ⑤	82	① ② ③ ④ ⑤	102	① ② ③ ④ ⑤
13	① ② ③ ④ ⑤	38	① ② ③ ④ ⑤	63	① ② ③ ④ ⑤	83	① ② ③ ④ ⑤	103	① ② ③ ④ ⑤
14	① ② ③ ④ ⑤	39	① ② ③ ④ ⑤	64	① ② ③ ④ ⑤	84	① ② ③ ④ ⑤	104	① ② ③ ④ ⑤
15	① ② ③ ④ ⑤	40	① ② ③ ④ ⑤	65	① ② ③ ④ ⑤	85	① ② ③ ④ ⑤	105	① ② ③ ④ ⑤
16	① ② ③ ④ ⑤	41	① ② ③ ④ ⑤	66	① ② ③ ④ ⑤	86	① ② ③ ④ ⑤	106	① ② ③ ④ ⑤
17	① ② ③ ④ ⑤	42	① ② ③ ④ ⑤	67	① ② ③ ④ ⑤	87	① ② ③ ④ ⑤	107	① ② ③ ④ ⑤
18	① ② ③ ④ ⑤	43	① ② ③ ④ ⑤	68	① ② ③ ④ ⑤	88	① ② ③ ④ ⑤	108	① ② ③ ④ ⑤
19	① ② ③ ④ ⑤	44	① ② ③ ④ ⑤	69	① ② ③ ④ ⑤	89	① ② ③ ④ ⑤	109	① ② ③ ④ ⑤
20	① ② ③ ④ ⑤	45	① ② ③ ④ ⑤	70	① ② ③ ④ ⑤	90	① ② ③ ④ ⑤	110	① ② ③ ④ ⑤
21	① ② ③ ④ ⑤	46	① ② ③ ④ ⑤						
22	① ② ③ ④ ⑤	47	① ② ③ ④ ⑤						
23	① ② ③ ④ ⑤	48	① ② ③ ④ ⑤						
24	① ② ③ ④ ⑤	49	① ② ③ ④ ⑤						
25	① ② ③ ④ ⑤	50	① ② ③ ④ ⑤						

自由記入欄