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Defining and Assessing Safety Culture in High Reliability Systems: An Annotated Bibliography

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Abstract

Recent years have seen a growing concern within the aviation industry for the latent effects that organizational factors can have on pilot performance in the cockpit, as well as the overall safety of flight operations in an airline. This concern stems from a recent rise in commercial aviation accidents apparently caused by ill-fated decisions made by upper level management, as well as academic research showing direct ties between organizational factors and safe performance of aircrews in the cockpit. Unfortunately, however, effective tools or methodologies for identifying and mitigating potentially harmful organizational factors before they cause an accident have yet to be developed. The purpose of the present document is to summarize research and technical reports that either directly study organizational factors affecting safety, such as safety culture, or discuss models and concepts of safety culture that can be used to design assessment techniques. The hope is that this review of the literature will provide a starting point for developing effective tools and methodologies for identifying and mitigating critical organizational factors before they cause accidents.

Anderson, N., & West, M. A. (1996). The team climate inventory: Development of the TCI and its applications in teambuilding for innovativeness. European Journal of Work & Organizational Psychology, 5(1), 53-66.

The Team Climate Inventory (TCI) describes the development and application of a facet-specific measure of group processes and climate for innovation. TCI is a 44-item scale, composed of 15 subscales, and five superordinate scales:
(1) Participative safety,
(2) Support for innovation,
(3) Vision,
(4) Task orientation, and
(5) Social desirability.
All scales and subscales revealed acceptable reliability and were shown to predict subsequent levels of team innovation. Two case studies of the use of the TCI with senior management teams in the UK are described to illustrate the use of the measure as a tool for teambuilding during a period of organizational change.

Bailey, L. L., Peterson, L. M., Williams, K. W., & Thompson, R. C. (2000). Controlled flight into terrain: A study of pilot perspectives in Alaska (DOT/FAA/AM-00/28).

Based on the "Swiss Cheese" Model of Accident Causation and the Human Factors Analysis and Classification System (HFACS), a 103-item questionnaire was developed covering the following domains:
(1) Organizational influences,
(2) Unsafe supervision,
(3) Preconditions for unsafe pilot acts, and
(4) Unsafe pilot acts.
This questionnaire was used to identify pilot and organizational risk factors for a Controlled Flight Into Terrain (CFIT) accident in Alaska. The survey successfully distinguished the perceptions of pilots of not-CFIT and CFIT companies in the following areas: organizational influences, preconditions for unsafe acts, and unsafe supervision. The survey revealed that pilots who worked for companies who had a CFIT accident rated their company's safety climate and practices significantly lower than pilots who worked for CFIT-free companies. Based on the results, several recommendations were developed to reduce the number of CFIT accidents in Alaska, which include: increase pilot awareness of CFIT safety-related issues, improve company safety culture, improve pilot training in the environment in which they commonly fly, improve weather briefings, and eliminate pressure to complete a flight.

BASI. (1996). <u>Proactively monitoring airline safety performance: Identifying needed defences in the civil aviation transport environment and an evaluation of the BASI-Indicate safety program</u>.

The need for proactive monitoring method of airline safety was addressed. Models of organizational accident causation and proactive defense evaluation were provided in which defenses are barriers or safeguards put in place to protect a system from both active and latent failures. A new proactive safety method for the airline industry called INDICATE (Identifying Needed Defenses In the Civil Aviation Transport Environment) was outlined. INDICATE is an airline self-management safety tool that encourages regular passenger transport operators to critically evaluate and continually improve the strength of their safety system. INDICATE also provides a formal communication channel for airline operators to regularly identify and report current weaknesses in aviation regulations, policies and standards to the Bureau of Air Safety Investigation (BASI), before they result in an accident. The procedures to develop INDICATE include:
(1) Identify and rank in order of importance all the potential hazards,
(2) For each identified hazard, determine the current defenses,
(3) Evaluate the effectiveness of those defenses, and
(4) Identify additional controls or procedures, or modifications to current defenses.
It is suggested to use safety climate and risk perception of aviation safety hazards measures to evaluating the effectiveness of INDICATE in improving airline safety performance.
The BASI-INDICATE program was evaluated using the data from a major Australian regional airline. INDICATE was implemented in one operational base, but not in another one (control group). Five evaluation criteria were applied to determine whether the program had a positive influence on the airlines' safety performance. These criteria were airline safety culture, staff risk perception of aviation safety hazards, willingness of staff to report safety hazards, action taken on identified safety hazards, and staff comments about how safety is managed within the airline. Results from the trial suggest that staff within the INDICATE base demonstrated a significant improvement in safety culture and a reduction in their perceived severity and likelihood of safety hazards occurring within the airline, were more willing to report safety hazards, and were much more positive about airline safety management, as compared to the Non-INDICATE base. In addition, a number of internal company safety issues and broader system safety deficiencies have been successfully addressed. The results provide strong evidence that the BASI-INDICATE program can effectively improve company safety performance.

Bierly, P. E., & Spender, J. C. (1995). Culture and high reliability organizations: The case of the nuclear submarine. Journal of Management, 21(4), 639-656.

Features of high-risk organizations (HRKOs) are complexity, tight coupling, and the potential for catastrophes. According to Perrow, accidents are normal for HRKOs because of the irreconcilable structural paradoxes: centralization and delegation. Centralization, for dealing with tight coupling, must be combined with delegation, for dealing with complexity. In contrast, Weick argues that strong organizational cultures provide a centralized and focused cognitive system within which delegated and loosely coupled systems can function effectively. HRKOs thereby become transformed into high-reliability organizations (HRLOs).
Bierly and Spender, focusing on the nuclear submarine, argue for a multilevel model in which culture interacts with and supports formal structure thereby producing high reliability. As shown in Rickover's example, NR culture, through a powerful system of selection and training, supports the formal structure of command aboard the submarine and provides a framework within which individuals at all levels can monitor, advise, criticize and support each other. Centralization based at the collective level can coexist with decentralization at the individual level, therefore a high-risk system can be transformed into a high-reliability system.

Butterfield, D. A., & Farris, G. F. (1974). The Likert organizational profile: Methodological analysis and test of System 4 theory in Brazil. Journal of Applied Psychology, 59(1), 15-23.

The Likert Organizational Profile (LOP) is a 20-item, 20-point scale. The 20-point scale is divided into four sections, each section representing one of the four management systems described by Likert's theory:
(1) Authoritative,
(2) Benevolent authoritative,
(3) Consultative, and
(4) Participative group.
The 20 items are grouped into six theoretical dimensions of organizational processes: leadership, motivation, communication, decision-making, goal setting, and control.
LOP was administered twice in 13 Brazilian development banks to obtain the actual and ideal bank profiles. The result showed that participative group management methods were ideal, but autocratic or consultative methods were actually used. Factor analyses did not yield the six dimensions predicted by Likert's theory. Factors were only partially consistent over time and for different hierarchical levels. Retrospective scores were accurate and were equally so for the 6-, 12-, and 18-month time periods since the original administration. Test-retest reliability of the LOP as a whole was moderate. Bank LOP scores were unrelated to objective measures of organizational effectiveness, but were positively related to employee subjective satisfaction. The LOP appears useful for current and retrospective organizational studies, but the theory of management systems it measured is only partially supported.

Carroll, J. S. (1998). Safety culture as an ongoing process: Culture surveys as opportunities for enquiry and change. Work & Stress, 12(3), 272-284.

Based on Reason's (1997) work, a safety culture project was conducted in an engineering department at a nuclear power plant. The project was structured in four phases:

(1) a safety culture questionnaire was designed, pilot tested, and delivered;
(2) individual and group interviews were conducted;
(3) the results of the analyses of questionnaire and interviews were reported to senior management, along with a discussion of recommendations;
(4) results were reported back to engineering department through normal departmental stand-down meetings.

The safety culture questionnaire consisted of two parts: 45 closed questions, each answered by using a four-category scale and a 'don't know' option; and 2 open-ended questions asking about the indicators of the strength of safety culture and the methods to improve the plant safety culture. The interviews were designed around seven questions, mostly based on themes arising from the questionnaire responses. Based on the analyses of questionnaire and interviews, six general conclusions and three recommendations were given to senior management. Although the plant engineering safety culture was in reasonable good health, the results suggested that safety was not understood consistently and comprehensively, communications up and down the hierarchy were not always effective, and supervisors were being placed in weak positions without the resources to carry out their expanding roles.

According to Corcoran's classification of four types of self-assessments (routine, pre-emptive, reactive, and periodic), the plant tends to hold these survey and enquiry techniques in reserve as a reactive response when issues arise, although it is suggested they could also be used as a periodic opportunity for dialogue.

Cheyne, A., Cox, S., Oliver, A., & Tomas, J. M. (1998). Modeling safety climate in the prediction of levels of safety activity. Work & Stress, 12(3), 255-271.

Structural Equation Model (SEM) techniques were used to examine the architecture of the relationships between components of organizational safety climate, including employee attitudes to safety issues and perceptions of the work environment, and related to self-reported levels of safety activity. A survey that consisted of demographic information, physical work environment, hazards checklist, attitudes to safety (including safety management, communication, individual responsibility, safety standards and goals, and personal involvement), and safety activities was used to collect data.

The data showed that a common structure, or architecture, of attitudes to safety issues and perceptions of the work environment could be constructed to explain the levels of safety activity. This suggests that a pivotal role is played on one hand, by the strength of employees' attitudes with regard to safety management, through both direct and indirect paths, and, on the other hand, by their views on individual levels of responsibility. This model highlights safety management as the most appropriate area to start any improvement program.

MANOVA & one-way ANOVAs were used to examine the differences between plants/sites. The results showed that employees differed in their attitudes to safety issues, such as the management of safety and communication, and in their perceptions of workplace hazards. It is intended that this model be further utilized within the organization under study as a basis for monitoring safety performance and planned improvements in safety.

Ciavarelli, A., Jr., & Figlock, R. (1996). Organizational factors in aviation accidents. Monterey, CA: School of Aviation Safety, Naval Postgraduate School.

The Organizational Safety Effectiveness Model identified five major areas regarding the effectiveness of organizations in managing risk:
(1) Process auditing,
(2) Reward system,
(3) Quality control,
(4) Risk management,
(5) Command control.
Based on this model, a 57-item, 7-point Command Safety Assessment questionnaire was developed and administered to various Naval force categories. The results showed that the ratings for most items, particularly those items related to command climate, qualification standards, safety training, and leadership issues, were highly favorable. The results also revealed a general concern about operational tempo, workload, staffing, and resource availability, and a perceived need to improve certain safety interventions, which would help reduce the aircraft mishap rate.
The Human Factors Checklist and Human Factors Risk Management Checklist were developed to classify potential sources of human error. The checklist is composed of eight key areas:
(1) Sensory/Perceptual,
(2) Medical/Physiological,
(3) Knowledge/Skill,
(4) Personality/Attitude,
(5) Judgment/Decision-Making,
(6) Communication/Crew Coordination,
(7) Design/Systems, and
(8) Supervisory/Organizational.

Cooke, R. A., & Szumal, J. L. (1993). Measuring normative beliefs and shared behavioral expectations in organizations: The reliability and validity of the organizational culture inventory. Psychological Reports, 72(3).

Normative beliefs are cognitions held by an individual regarding others' expectations of his behavior as a member of a particular group or organization. Shared behavioral expectations are those normative beliefs that are held in common by the members of a group or organization. The Organizational Culture Inventory (OCI) measures 12 sets of normative beliefs or shared behavioral expectations along two underlying dimensions: "task-people" orientation, and "security-satisfaction" orientation. The measures are categorized into three types of organizational cultures: constructive, passive-defensive, and aggressive-defensive.
The empirical data revealed high internal consistency, interrater agreement, test-retest reliability, and provided support for construct validity and criterion validity, indicating that the OCI is dependable for assessing normative aspects of culture. The normative beliefs were differentially related to the levels of satisfaction and stress at individual level and organizational level.

Cooper, M. D. (2000). Towards a model of safety culture. Safety Science, 36(2), 111-136.

Various definitions of organizational safety culture were reviewed. It was argued that most research conceptualized this construct solely on internal psychological aspects, ignoring situational constraints and people's actual behavior. In this article, a conceptualization of the safety culture 'product' is offered, with which to provide a dependent variable that can be used to evaluate the effectiveness of the many goal-directed manipulations that may be adopted when examining safety culture.
Based on goal-setting paradigm and Social Cognitive Theory, a reciprocal model of safety culture, which takes into account subjective internal psychological factors, observable ongoing safety-related behaviors and objective situational features, is offered, to provide both a theoretical and practical framework with which to measure and analyze safety culture. The presented model was compared with other existing safety culture models. Measurement tools and quantification strategies were offered. Levels of measurement and analysis were discussed. Supporting evidence for this model was reviewed. And finally, implications for future research to establish the model's utility and validity are addressed.

Cox, S., & Cox, T. (1991). The structure of employee attitudes to safety: A European example. Work & Stress, 5(2), 93-106.

Research on safety culture has focused on two main issues: objects and subjects of attitudes to safety. Objects include safety hardware and physical hazards; safety software and concept; people; and risk. Subjects include workers, management, safety specialist advisers, and trade union officials. In this study, an attitude survey was developed focusing on attitudes to aspects of safety, software, people, and risk, and administered in a European company. Factor analysis suggested that employees' attitudes to safety could be mapped by 5 orthogonal factors:
(1) Personal skepticism,
(2) Individual responsibility,
(3) "Safeness" of the work environment,
(4) Effectiveness of arrangements for safety, and
(5) Personal immunity.
Building on this model, it is suggested that strategies for enhancing an organization's safety culture through attitude change should consider both the reinforcement of constructive beliefs and the extinction of unconstructive and negative beliefs.

Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? Work & Stress, 12(3), 189-201.

This article is an introductory paper to a special issue on Safety Culture, addressing some key issues relating to the definition, measurement and utility of the safety culture concept. First, the background and origins of safety culture was given. Second, safety culture was compared with safety climate. The ACSNI definition of safety culture has been widely accepted: the safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management. Safety culture and safety climate are analogized of personality and mood of an organization respectively. Third, three principle methods of deconstructing the essential elements of an organizational safety culture, which are case studies (of crisis-prone organizations, high-reliability organizations, and organizations experiencing change), comparative studies, and psychometric surveys, were discussed. Finally, the utility of this concept was addressed, and future directions in this area were given.

Dastmalchian, A., Blyton, P., & Adamson, R. (1989). Industrial relations climate: Testing a construct. Journal of Occupational Psychology, 62(1), 21-32.

Industrial Relations Climate (IRC) is defined as a subset of an organizational climate that pertains to the norms and attitudes reflecting union-management relationships in an organization. A 26-item 5-point measure of IRC was developed and validated in this study. Factor analysis revealed five factors: harmony, openness, hostility, apathy, and promptness. Results showed that the IRC measure is reliable and capable of being applied within different work contexts. Four of the climate scales also demonstrated strong within-organization and within-group agreement (based on union/nonunion membership, bargaining unit, and departmental affiliation). The IRC appeared to be related to some organizational outcomes such as absenteeism and turnover. The authors conclude that potential links might exist among three sets of variables: context, climate, and outcomes of industrial relations. This measure of IRC could serve as a diagnostic tool in the context-climate relationship and a predictive tool in the climate-outcomes relationship.

Deal, T. E., & Kennedy, A. A. (1983). Culture: A new look through old lenses. Journal of Applied Behavioral Science, 19(4), 498-505.

This work discusses the revival of interest in the role that cultural, rather than rational, factors play in how organizations function. It is argued that every organization has a distinctive culture that has evolved through trial and error and that includes shared values, heroes that embody these values, rituals and ceremonies, and cultural networks. In stronger, more cohesive cultures, members' behaviors are constrained by mutual accord rather than command. By characterizing the business environment as having two main dimensions, degree of risk and speed of feedback, four basic cultural types were identified in different contexts:
(1) Tough-guy/Macho culture — high risk and quick feedback,
(2) "Bet your company" culture — high risk and slow feedback,
(3) "Work hard/Play hard" culture — low risk and quick feedback, and
(4) Process culture—low risk and slow feedback.
The metaphor of organizational culture in behavioral science research helps us understand what more rigorous concepts miss, but also leaves much uncovered and unexplained. In the realm of basic science, the criteria to assess a concept are replicability, generalizability, and reliability; in applied science, the criterion is usefulness. It is argued that organizational culture is a concept that is both powerful and useful.

Eiff, G. (1999). Organizational safety culture. Paper presented at the Tenth International Symposium on Aviation Psychology. Columbus, OH.

The necessary attributes of a safety culture, and what it must have as well as what it must become in order to be effective at fostering safety at all levels, were reviewed. According to Reason, safety cultures must be "informed cultures" characterized by being a good reporting culture, a committed learning culture, an organizationally flexible culture and a just adjudicative and disciplinary culture. Management and the individual employee's role of promoting safety culture were discussed. This article also explored the difference between "corporate cultures" and "work cultures" and discussed how a correctly developed corporate culture provided the opportunity for a safety culture to develop but did not insure its establishment. The paper related research findings, concerning how charismatic workers and managers, who actually defined the cultural focus of the workplace, influenced local cultures' definitions of safety. The paper concluded by answering the nagging question of how safety culture might be successfully developed within the context of the aviation maintenance work environment by discussing an experimental strategy currently being evaluated by Purdue researchers to integrate safety advocacy into aviation maintenance environments. This strategy was called Safety Action Team, which utilized a peer monitoring, mentoring, and adjudication process coupled with a highly diversified communication strategy to insure that problems are reviewed and addressed by representatives from all career field.

Fisher, C. J., & Alford, R. J. (2000). Consulting on culture: A new bottom line. Consulting Psychology Journal: Practice & Research, 52(3), 206-217.

Due to the long-standing disagreement over definitions, origins, and approaches on business culture, there has been a fundamental confusion about culture and its impact on business performance. A new model, presented in a graphic format called *circumplex*, is introduced in this article. This model measures four basic business culture traits:
(1) Mission -- representing external focus and supporting stability,
(2) Involvement -- representing internal focus and supporting flexibility,
(3) Adaptability -- representing external focus and supporting flexibility, and
(4) Consistency -- representing internal focus and supporting stability.
This model enables us to quantify culture using business language and concepts, thereby establishing a clear link with meaningful business results such as profitability, market share, and sales growth. Research clearly shows that, regardless of the size, sector industry, or age of a business, culture effects performance. The authors also looked at Denison's research, which shows that the highest performing companies are those that show strength in all four areas. Among these four areas, mission and involvement are most powerful in effecting performance outcomes. In addition, there are significant relationships between individual culture traits and specific performance measures. This model provides substantial new resources for consultants who want to help clients understand the real importance of culture, precisely target their own cultures for specific results, and consciously lead those cultures for sustainable business success.

Fleming, M. T., Flin, R., Mearns, K., & Gordon, R. (1996). The offshore supervisor's role in safety management: Law enforcer or risk manager. Paper presented at the Third International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. New Orleans.

Safety professional's opinions and research evidence regarding the role of superiority in safety management were reviewed, suggesting that Superiors play a very important role in safety management. A study designed to examine the role of the Superior in safety and to identify best supervisory practice in offshore worksite risk management was presented. The study was carried out in two phases:

(1) holding discussion groups with workers to establish the key skills and behaviors for effective supervision,
(2) interviewing supervisors using Critical Incident Technique, distributing a questionnaire to measure the subordinates' risk taking behaviors and evaluation of the supervisors.

The Superiors were classified into effective and less effective ones according the level of risk taking behavior of their work groups. The differences between effective Superiors and less effective Superiors were identified. The results showed that the most effective supervisors were similar: they tended to use a more participative management style. They saw themselves as risk managers who took a broad perspective and used the expertise of all those involved in the task to effectively manage the risks and their work force. They emphasized teamwork and the expertise of their work group. They appeared to value their work group and the work that they performed. They seemed to see safety as important and major part of their role, as an objective overseer. They spoke of managing the risks and carrying out risk assessments based on the knowledge gathered from the workers involved in the operation. The poorer supervisors differed from effective superiors and from each other in management style.

Flin, R., & Martin, L. (1997). Behavioral markers for CRM. Paper presented at the Ninth International Symposium on Aviation Psychology. Columbus, OH.

Crew Resource Management (CRM) was designed to improve social and cognitive skills on the flight deck with the aim of pilots applying non-technical skills to reduce the risk of accidents where such psychological factors can play a central or contributory role in the causation chain. During the last two decades, however, CRM has been in danger of losing its focus. Refocusing requires the establishment of a set of behavioral makers. This paper describes a study aimed at collating and synthesizing a sample of evidence on CRM behavioral makers and their current use in the UK, mainland Europe and the USA. The initial stage of this collation data was presented, and a description of items was given. Two arising issues—item meaning and boundaries between items were discussed.

Flin, R., Mearns, K., Gordon, R., & Fleming, M. T. (1998). Measuring safety climate on UK offshore oil and gas installations. Paper presented at the 1998 SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. Caracas, Venezuela.

Offshore Safety Questionnaire (OSQ) was developed to measure the safety climate on UK offshore oil and gas installation. The questionnaire comprised six sections:
(1) general information,
(2) your job, which consisted of work environment scale (work pressure and work clarity), job communication scale, safety behavior scale, and job security scale,
(3) experience of risks—hazards and work tasks,
(4) assessment of safety,
(5) safety culture, and
(6) accident history.
The questionnaire was distributed to offshore installation operators and contractor staff. Factors that were found to predict good safety management with regard to respondents' accident involvement and unsafe behaviors were presented. The results showed that 'attitude to violations' and 'work pressure' were the two factors that best predict self-reported frequency of unsafe behavior, while self-reported violations and satisfaction with accident prevention measures, together with two safety attitudes (speaking up about safety and attitude to violations), predicted accident and near-miss involvement best.

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (1998). Measuring safety climate: Identifying the common features. Safety Science, 34, 177-192.

The common themes of 18 safety climate surveys were examined. The results suggest that the most typically assessed dimensions are related to management, safety system, and risk, followed by work pressure and competence. Each of these common themes was defined and discussed separately. In addition, the authors suggested that procedures/rules might be worthy of more attention.

Flin, R., O'Connor, P., Mearns, K., & Gordon, R. (1998). Crew resource management for offshore teams: Lessons from aviation. Paper presented at the 1998 SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. Caracas, Venezuela.

A human factors training program—Crew Resource Management (CRM) was presented and introduced into offshore industry.
CRM is "using all the available resources—information, equipment, and people—to achieve safe and efficient flight operations". The teaching methods used in CRM training in aviation include lectures, classroom training, practical exercises, case studies, and films. Six core topics were established through accidents analysis, pilot interviews, and observations of flight crews in simulators: team work, leadership, situational awareness, decision making, communication, and personal limitations. Three methods for assessing the outcomes of CRM training were discussed, which include crew behavior, students' attitudes, and learning and motivation.
The rationale for CRM training offshore was given. Finally, two examples in which CRM training has been used by a major North See Oil company and a form of CRM training called Emergency Resource Management training were presented.

Flin, R., O'Connor, P., Mearns, K., & Gordon, R. (1999). Crew resource management for offshore production and maintenance. Paper presented at the 1999 Offshore Europe Conference. Aberdeen, Scotland.

Crew Resource Management (CRM), which is widely used in aviation, is adapted for offshore teams. The training is delivered over two days, and consists of six core topics: situation awareness, decision making, communication, team coordination, fatigue and shiftwork, and stress.
The background of CRM in aviation and the rationale for CRM training for offshore teams were provided in this article. A prototype offshore CRM course was described. Also, methods of evaluating the training (crew behavior, participants' attitudes, and learning and motivation), and suggestions for improving the training course were identified.

Geller, E. S. (in press). Ten principles for achieving a total safety culture. Professional Safety.

Characteristics of Total Safety Culture (TSC), and ten basic principles on which to base "people processes" for achieving a TSC are discussed. Generally, a TSC requires continual attention to three domains:
(1) Environmental factors,
(2) Personal factors, and
(3) Behavioral factors.
The principles implicate five processes or intervention domains:
(1) Interpersonal observation and feedback,
(2) Safety coaching for interpersonal feedback,
(3) Incentives and rewards for process activities,
(4) Techniques to increase actively caring, and
(5) Evaluation of environmental, behavioral, and personal factors.

Glick, W. H. (1985). Conceptualizing and measuring organizational and psychological climate: Pitfalls in multilevel research. Academy of Management Review, 10(3), 601-616.

The author advocates treating the *organization* as the unit of theory for organizational climate while preserving the *individual* as the unit of theory for psychological climate. Multilevel conceptual problems in climate research are examined and strategies for improving the validity and assessing the reliability of measurement are discussed. The conceptualization calls for recognizing multiple units of theory; defining climates independently of one another; studying the social and organizational determinants of the climate over time; empirically testing composition rules; and interpreting perceptual agreements in terms of measurement accuracy for organizational climate. This is done while at the same time, exploring different interpretations of perceptual agreement on the psychological climate and recognizing the benefits of diversity in climate dimensions. In addition, the differences between organizational climate and organizational culture are discussed.

Gordon, R. P. E. (1998). The contribution of human factors to accidents in the offshore oil industry. Reliability Engineering and System Safety, 61, 95-108.

Literature on human errors, human factors, and how they contribute to accidents in the offshore oil industry is reviewed. Based on the analysis of 25 accident reporting forms from offshore oil companies in the UK sector of the North Sea, an improved framework of accident reporting forms is proposed. This framework uses human error categories to determine the immediate cause of the accidents, and human factors categories to determine the underlying causes of the accidents. Human errors are defined in terms of the type of activity that is being performed (skill, rule, or knowledge based). Skill based slips and lapses include "action" and "checking", rule based mistakes include "retrieval" and "transmission", and knowledge based mistakes include "diagnostic" and "decision" errors. Human factors consist of three main categories: organizational factors which include company policies, company standards, systems and produces; group factors which include management weaknesses, supervision and crew factors; and individual factors which include competence, stress and motivation. Also, the methods by which accidents could be reduced is discussed by focusing on the human factors, such as feedback from accident reporting in the oil industry, auditing of unsafe acts and latent failures.

Gordon, R., Flin, R., Mearns, K., & Fleming, M. T. (1996). Assessing the human factors causes of accidents in the offshore oil industry. Paper presented at the Third International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production. New Orleans, LA.

The importance of human factors in industrial safety and the role of human factors in reduction of accidents were discussed. Human factors codes in high reliability industries such as the nuclear, mining and marine were reviewed. Based on a review of the current accident coding systems used by 30 offshore oil operating and contracting companies in the UK, a more comprehensive human factor coding category for accident reporting systems was presented. This coding system includes three main themes:

(1) Organizational/management factors, which include company policies and standards and management weaknesses,
(2) Job factors, which include supervision and task, and
(3) Personal factors, which include capability, knowledge/skill, stress, and improper motivation.

This coding system is intended to be used for accident reporting, safety training and for raising awareness of the human factors causes of accidents.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. Journal of Occupational Health Psychology, 5(3), 347-358.

This framework for measuring perceptions of safety at work was developed and supported by two studies. In this framework, safety climate is incorporated as a higher order factor comprising specific first-order factors such as management values, safety communication, safety practices, safety training, and safety equipment. Secondly, safety climate is distinguished from other perceptions related to safety such as self-reports of individual safety performance, and from the motivational and knowledge determinants of this behavior. This distinction allows hypotheses regarding the mechanisms through which a safety climate influences safety performance, to be developed and tested. Thirdly, safety performance is divided into task performance; safety compliance, which refers to behaviors directly related to safe work practices, and contextual performance; safety participation, which refers to behaviors that support the overall safety of the organization. Finally, perceptions of knowledge about safety and motivation to perform safely influence individual reports of safety performance and mediate the impact of safety climate on individual safety performance. This framework can be used to aid the design and evaluation of organizational interventions designed to enhance safety outcomes.

Griffin, M. L. (1999). The influence of organizational climate on detention officers' readiness to use force in a county jail. Criminal Justice Review, 24(1), 1-26.

Eight scales measuring a detention officer's perception of 3 dimensions of the organizational climate tested the hypotheses that perceptions of climate have a direct effect on a detention officer's readiness to use force and that these observed effects remain statistically significant when the individual characteristics of the officer are controlled. The 3 dimensions of organizational climate are:

(1) Structure and organization, comprising three climate scales: institutional operations, training, and role ambiguity,
(2) Supervision and support, comprising two climate scales: organizational support and quality of supervision, and
(3) Personal efficacy with the setting, comprising three climate scales: alienation, authority, and fear of victimization.

Results of the analysis confirm these hypotheses, indicating that expressed readiness to use force is influenced differentially by the 3 dimensions of climate and that individual characteristics of officers do not affect the expressed readiness to use force. However, only some of the climate factors, authority, fear of victimization, quality of supervision, and role ambiguity, have a statistically significant effect on the readiness to use force.

Gunter, B., & Furnham, A. (1996). Biographical and climate predictors of job satisfaction and pride in organization. Journal of Psychology, 130(2), 193-208.

Correlation analysis and step-wise regression analysis were used in four public sector organizations to examine the relationship of six biographical and 14 climate perceptions with reported job satisfaction and pride in the organization. Overall, perceived climate factors turned out to be more significant and powerful than biographical factors as predictors of job satisfaction and pride, but the predictability of different climate factors varied. Biographical data emerged as predictors only in relation to pride in the organizations. Although all four organizations were comparable public sector organizations, the results suggested that there were noticeable differences among the organizations in the overall significance of climate and in the types of climate variables that emerged as significant predictors.

Helmreich, R. L., & Merritt A. C. (1998). Organizational culture. In R. L. Helmreich & A. C. Merritt (Eds.), Culture at work in aviation and medicine (pp. 107-174). Brookfield, VT: Ashgate.

In chapter 4, organizational culture and cultural strength was defined. An approach to the study of organizational culture combining the managerial, anthropological and psychological approaches was used in this chapter. Two US airlines were compared on various parameters to highlight the best and worst organizational cultures among nine US-based airlines. Different subcultures may exist in the same organization, but an integrated organizational culture would have a positive impact on service and safety. An integrated organizational culture needs the cooperation within and between the 'operators', the 'engineers', and the 'executives.' Finally, strategies of strengthening the organizational culture were discussed.
In chapter 5, safety culture was defined as an organizational outcome of the interactions between professional, national and organizational culture, as well as organizational climate and training. It was suggested that error management was an essential strategy for achieving a safety culture. For diagnosing an organization's health and practices, empirical data are needed. Methods of acquiring diagnostic data under reactive and proactive research strategies were discussed. Followed the research findings into crew behavior. The role of CRM in changing behavior and the effect of operational complexity on performance and automation usage were discussed. Finally, how the issues of culture, error and error management intersect in the operating room and the parallels between the flightdeck and operating room were demonstrated.

Hendrick, H. W. (1991). Ergonomics in organizational design and management. Ergonomics, 34(6), 743-756.

The historical development of ergonomics in organizational design and management (ODAM) is reviewed. Within the framework of human-systems interaction, macroergonomics is characterized by organization-machine interface technology, which focuses on the proper fit between organizational design and the technology employed, or to be employed, in the system to optimize human-system functioning. Organizational design is focused on three major components: complexity, formalization, and centralization. In the sociotechnical systems model, organizations are conceptualized as having two major components: a technical subsystem and a personnel subsystem. Hendricks notes three sociotechnical system considerations in organizational and work system design:
(1) the technological subsystem;
(2) the personnel subsystem; and
(3) the relevant external environment.
In the technological subsystem, four different knowledge-based technologies (routine, non-routine, engineering, and craft technologies) are defined according to task variability and analyzability. In the personnel subsystem, the degree of professionalism and the psychosocial characteristics of the workplace are important to organizational design. In addition, environmental change and complexity also have important influence on the effectiveness of an organization's design. Finally, macroergonomics methods and applications are summarized.

Hofmann, D. A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accidents. Personnel Psychology, 49(2), 307-339.

Using a cross-level research strategy, three group-level factors (group process, safety climate, and intentions to approach other team members engaged in unsafe acts) and one individual-level factor (perceptions of role overload) were postulated to influence the frequency of reported unsafe behaviors. The 13-item scale from the Jones and James, Psychological Climate Survey measured perceptions of role overload. A 7-item scale from the Survey of Organizations measured group process. A 9-item scale based on Zohar's measure measured safety climate. Approach intention was measured using 6 behavior types, 4 injury levels, and 3 reaction levels. Unsafe behaviors were measured using a 29-item 6-dimension behavior list. Data were collected from 21 teams and 204 subjects in a chemical processing plant, and HLM was used to analyze the data. Both the individual and group-level variables were significantly associated with unsafe behaviors, thus supporting the cross-level hypotheses. There was evidence suggesting that the group process/unsafe behavior relationship was mediated by intentions to approach other team members engaged in unsafe acts. At the team level of analysis, safety climate and unsafe behaviors were significantly associated with actual accidents, while group process and approach intentions were marginally related to actual accidents.

Isaac, R. G. (1993). Organizational culture: Some new perspectives. In R. T. Golemanbiewski (Ed.), <u>Handbook of organizational behavior</u> (pp. 91-110). New York: M. Dekker.

Several issues related to organizational culture were discussed in this chapter, which include the definitions and components of organizational culture (values, beliefs, ideologies, attitudes and artifacts); the genesis of cultural elements and the major mechanisms associated with culture formulation; the problems associated with culture maintenance (recruitment and socialization); the problems with culture transmission in socialization (unconscious awareness of organizational culture, the level of socialization, and the immutability of cultural elements); issues on culture change at organizational level (processes of culture change, tools and recipes for cultural intervention, timing for intervention, and problems associated with culture change interventions); and issues on culture strength (definition of culture strength, arguments for and against promoting robust cultures, factors influence the strength of organizational culture, alternative model of culture strength, and levels of analysis on culture strength). Based on the discussion on the above aspects of organizational culture, current status of organizational culture research was summarized and issues needing attention were listed.

James, L. R. (1988). Organizational climate: Another look at a potentially important construct. In S. G. Cole, R. G. Demaree, & W. Curtis (Eds.), <u>Applications of internationist psychology: Essays in honor of Saul B. Sells</u> (pp. 253-282). Hillsdale, NJ: Elbaum.

Organizational climate involves the aggregation of psychological climate scores. It is suggested that the prerequisite for aggregating individual psychological climate scores should be an acceptable perceptual agreement. And the traditional criterion for perceptual agreement is a reasonably high intraclass correlation (ICC) estimate of interrater reliability. The appropriateness of the ICC in estimating interrater reliability is discussed. It is concluded that use of the ICC that relies on between-environment differences will result in an underestimate of interrater reliability if the mean climate scores do not vary appreciably among environments and individuals within environments tend to agree. That is, the underestimation of interrater reliability is expected to occur when sampling environments from a single type of environment or similar types of individuals within homogeneous environments.

A new method for estimating interrater reliability is overviewed as an alternative to the ICC approach. This method employs a within-groups design in which interrater reliability is estimated separately for each group. The interrater reliability within a group is viewed as a function of two variables: the observed variance among the ratings on a climate item X, designated S_X^2, and the expected variance among the ratings on climate item X in a condition of no agreement, designated σ_E^2. The interrater reliability is defined as $r_{WG} = 1- (S_X^2/\sigma_E^2)$. Using the same procedure, the interrater reliability among rater composite scores can be estimated in the form of means. Examples show that the interrater reliability estimated using the new method is higher and more consistent with the data than ICC. Finally, empirical comparison of between-groups and within-groups approaches is presented.

Jones, A. P. (1988). Climate and the measurement of consensus: A discussion of "Organizational climate". In S. G. Cole, R. G. Demaree, & W. Curtis, (Eds.), Applications of interactionist psychology: Essays in honor of Saul B. Sells (pp. 283-290). Hillsdale, NJ: Erlbaum.

Climate research suggests that "organizational climate" should be used to describe situationally based consistencies in an organization's treatment of individuals, whereas "psychological climate" is more appropriate when referring to the individual's perceptually-based representation of the work environment. Researchers argue that perceptual consensus should be obtained for individual observers before perceptual data can be used as a legitimate index of the situation. This research addresses four major psychological climate issues concerning the meaning of agreement:

(1) The presumed nature of the psychological climate,
(2) What it means to show agreement on ratings of the psychological climate,
(3) The degree that the methods espoused in the current perspectives are consistent with theory, and
(4) The implications of such viewpoints for future climates.

First, schema theory suggests that individual's report and interpretation of an event are prone to extensive distortion. Second, the agreement on psychological climate is difficult to interpret. It might results from substantially different events; it might differ according to different levels of the organization; it also might just reflect the common influence of shared methodology. Third, the theory and preferred method are usually so co-defined that the research in support of paradigm is not comparable with research addressing alternative paradigms. Due to all these potential problems, a refined measure of consensus by itself, though seems to be a helpful methodological tool, is unlikely to resolve the basic problems inherent in climate research if it is not accompanied by a clearer conceptual rationale for expecting such consensus, a better articulation of the meaning of consensus, and a direct assessment of the processes thereby environment information is perceived and interpreted.

Katz, J. H., & Miller, F. A. (1996). Coaching leaders through culture change. Consulting Psychology Journal: Practice & Research, 48(2), 104-114.

To enable organizations to capitalize on the advantages offered by diversity in the workforce and marketplace through culture change, senior leaders need a new set of competencies. To learn these new competencies, leaders need the support of skilled coaches who can show them the need for culture change; create a safe environment for learning; and model the skills necessary to lead a diverse, inclusive workforce through the culture change process. A model, "The Path From a Monocultural Club to an Inclusive Organization", which identifies six different stages of development along a continuum between exclusive and inclusive organizational cultures, was presented to help leaders in achieving successful culture change. The stages consist of exclusive clubs, passive clubs, symbolic difference organizations, organizations at critical mass, organizations at acceptance, and inclusive organizations. This model identifies the need for different leadership strategies and actions at different stages along the continuum. Specific examples are provided to facilitate the coaching process and the development of partnerships that will enable leaders to learn and grow.

Kivimaeki, M., Kuk, G., Elovainio, M., Thomson, L., Kalliomaeki-Levanto, T., & Heikkilae, A. (1997). The team climate inventory (TCI)--four or five factors? Testing the structure of TCI in samples of low and high complexity jobs. Journal of Occupational & Organizational Psychology, 70(4), 375-389.

Two versions of the Team Climate Inventory (TCI), consisting of either four or five factors, have been established in innovation research. The four-factor version consists of
(1) vision,
(2) participative safety,
(3) task orientation, and
(4) support for innovation,
whereas the five-factor version consists of
(1) vision,
(2) participative safety,
(3) task orientation,
(4) support for innovation, and
(5) interaction frequency.
The psychometric properties of these two alternative versions of TCI were compared in this study. Exploratory factor analysis of the entire sample reproduced both versions with good internal consistencies. When a distinction was made between samples with low and high job complexity according to DOT, significant differences between the four- and five-factor versions emerged. Exploratory factor analysis of the sample with low job complexity suggested that both versions obtained clear and interpretable structures. However, only the five-factor version obtained a clear factor structure in the sample of high job complexity. Further LISREL confirmatory factor analyses of both samples suggested that the five-factor structure provided significantly better fit to the data than the four-factor version. In conclusion, the five-factor version of the TCI is preferred to the four-factor version because it is more structurally intact and less likely to be affected by job complexity.

Klein, R. L., Bigley, G. A., & Roberts, K. H. (1995). Organizational culture in high reliability organizations: An extension. Human Relations, 48(7), 771-793.

High reliability organizations (HROs) are defined as organizations that are mandated to do everything possible to avoid altogether certain kinds of negative outcomes. Schulman offers a typology of organizations in which HROs are viewed as decomposable, clearance-focused, action-focused, or holistic, based on answers to two questions: whether or not actions required to insure safety are localized or system-wide, and whether or not analyses required to insure safety are localized or system-wide.

In this study, organization culture assessments in two HROs were compared with each other, with similar assessments done in other HROs, and with assessments done in other kinds of organizations. The two HROs that participated in the study were the US Federal Aviation Agency Regional Air Traffic Control Center, classified as a decomposable HRO, and a nuclear power plant, classified as a holistic HRO. The Organization Culture Inventory (OCI), which differentiates 12 basic culture styles, was used to assess the organizational culture.

The results suggest that HROs have different culture patterns than other kinds of organizations. HROs show few hierarchical differences in cultural norms, in contrast with other organizations that show strong vertical and horizontal differences in employee perceptions. In addition, attitudes and role perceptions are related to cultural factors somewhat differently in HROs than they are in other kinds of organizations. The field data support the notion that a holistic and a decomposable HRO are slightly different from one another. The holistic HRO depends on constant meetings and negotiation to insure safety while the decomposable HRO relies much more on individual action.

Lee, T. (1998). Assessment of safety culture at a nuclear reprocessing plant. Work & Stress, 12(3), 217-237.

The development and validation of a survey at the Sellafield site of British Nuclear Fuels in Cumbria was described in this article. The procedure was as follows: five focus groups were held to elicit safety-relevant beliefs, attitudes and values. The first draft questionnaire was constructed based on the transcript. The draft version was administered to all who had taken part and an open meeting was held to discuss shortcomings and possible amendments. Administration of the questionnaire to a pilot group and finally, the resulting 172-item questionnaire, a 7-point Likert scale, which covered 9 safety domains: procedures, risks, job satisfaction, rules, participation, training, control, and plant design. Each domain was analyzed using principal components analysis, 38 factors were extracted, and the 19 accounting for the most variance were selected. Factor scores were validated against the reported number of lost-time accidents. Sixteen out of 19 discriminated at high levels of significance. A generic analysis of the full questionnaire and secondary factor analysis of the primary factors were also conducted, but showed no advantage. A reduced version with 81 items resulting from the within-domain analysis performed as well as the original, with considerable improvement in validity obtained by using discriminant function coefficients to weight items in regression scores in place of factor loadings. Feedback was provided for subgroups, based on gender, age, length of service, active area involvement, days/shift, department, and type of work or job type. The application of the questionnaire in measuring safety culture and the methods to address the weakness revealed by this safety survey and improve the safety culture were discussed.

Luxhoj, J. T., & Arendt, D. N. (2001, draft). Application of systems engineering capability maturity model (SE-CMM) to aviation organizational factors.

The Systems Engineering Capability Maturity Model (SE-CMM) is presented, which propose that product quality directly results from people, process, and technology capabilities. This model further divides capacity into six levels within an organization with respect to people, process, and technology. The six capacity levels are not performed, performed informally, planned and tracked, well-defined, quantitatively controlled, and continuously improved. This paper presents a framework for extending the SE-CMM to aviation organizational factors. As an example of systems engineering approaches, the Air Transportation Oversight System (ATOS) was used to illustrate the possible application of the SE-CMM. According to ATOS, air carrier operations are classified into seven systems. These seven systems are evaluated across six systems safety attributes. By expanding the ATOS questions to allow differentiation into six capability maturity levels across 6 systems safety attributes, deeper insights into interactions of inspection elements and the corresponding strengths/weaknesses of air carriers' processes may be obtained, leading to more focused safety interventions.

McDonald, N., & Ryan, F. (1992). Constraints on the development of safety culture: A preliminary analysis. Irish Journal of Psychology, 13(2), 273-281.

Safety culture is defined as a set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious. Perrow's interactive chart was presented, which views organizations as dynamic entities with technological and social systems that can be broken down into two bipolar variables: linear vs. complex interactions and tight vs. loose coupling. Most theories have seen safety culture as being relatively autonomous and open to manipulation by both external agencies, like consultants, and internally, from management and employees alike. Using the road transport industry as example, the authors address the environment in which safety culture operates (the constraints, limitations, and opportunities for the development that it places on the organization and its members). The degree of control and the consequences prove to be conditioned by factors inside and outside the organization. It is therefore argued that an adequate theory of safety culture cannot be reached unless the role and influence of a range of factors operating in the environment of the organization are taken into account.

Mearns, K. J., & Flin, R. (1999). Assessing the state of organizational safety--Culture or climate? Current Psychology: Developmental, Learning, Personality, Social, 18(1), 5-17.

Literature was reviewed on safety culture and safety climate in an attempt to determine which is the more useful for describing an organization's "state of safety." It is argued that, although the two terms are often interchangeable, they are actually distinct, but related concepts and should be treated accordingly. The term "safety climate" is contended to best describes employees' perceptions, attitudes, and beliefs about risk and safety, typically measured by questionnaire surveys and providing a "snapshot" of the current state of safety. "Safety culture" is argued to be a more complex and enduring trait reflecting fundamental values, norms, assumptions and expectations, which to some extent reside in societal culture.

It is suggested that safety should be assessed at two levels:

(1) The more general level as predicted by norms, implied assumptions, and values (i.e., strategic/cultural);

(2) At the specific level as it related to particular work tasks within the organization (tactical/climatic).

To some extent, the "cultural" elements of safety could reside in the societal culture in which the organization is located, which in turn influences how the safety climate within the organization develops. The authors conclude that the measurement of safety culture requires in-depth investigation including an analysis of how organizational members interact to form a shared view of safety.

Mearns, K., Flin, R., Gordon, R., & Fleming, M. T. (1998). Measuring safety climate on offshore installations. Work & Stress, 12(3), 238-254.

Safety culture was defined, the distinction between culture and climate was reviewed, and the importance of organizational subculture was discussed.
The safety climate was examined on 10 UK offshore oil installations using the Offshore Safety Questionnaire, which measured work pressure and clarity, job communication, safety behavior, risk perception, satisfaction with safety measures, safety attitudes, and accident history. The result showed that most respondents felt safe with respect to a range of hazards and expressed satisfaction with safety measures. They reported little risk-taking behavior and felt positive about levels of work clarity and job communication. There was a wider diversity of opinions on the safety attitudes scale, indicating a lack of a positive, concerted safety culture and a range of fragmented safety subcultures, which varied by seniority, occupation, age, shift worked, and prior accident involvement. It is suggested that these subcultures partly determine an installation's safety climate. It is suggested that a strong, cohesive culture with respect to safety is not necessarily beneficial, possibly leading to complacency.

Mearns, K., Whitaker, S., Flin, R., Gordon, R., & O'Connor, P. (2000). Factoring the human into safety: Translating research into practice. HSE OTO 2000 061 Report, Vol (1).

Benchmarking is defined as "a process of continuously measuring and comparing an organization's business processes against process leaders anywhere in the world to gain information which will help the organization to take action to improve its performance".

In this study, two measurement instruments were developed to investigate the feasibility of benchmarking human and organizational factors in offshore safety. The Safety Management Questionnaire (SMQ) was developed to tap the internal business process of each installation in the area of health and safety. The Offshore Safety Questionnaire (OSQ) was designed to assess safety climate on each installation. The first version of OSQ comprises 7 factors:

(1) health and policy awareness,
(2) workforce involvement in health and safety,
(3) communication about health and safety,
(4) job satisfaction,
(5) satisfaction with various accident prevention activities,
(6) Attitudes toward: speaking up about safety; management commitment to safety; supervisor commitment to safety; and rules and regulations, and
(7) self-reported safety behavior.

The second version represents 6 factors:

(1) workforce involvement in health and safety,
(2) communication about health and safety,
(3) satisfaction with various accident prevention activities,
(4) attitudes toward: speaking up about safety; management commitment to safety; supervisor commitment to safety; and rules and regulations,
(5) work pressure, and
(6) self-reported safety behavior.

The results of the studies suggested that the benchmarking exercise largely achieved its goal. Benchmarking safety climate was especially successful in highlighting the areas that require intervention. A model of safety climate process was formed based upon the results, which can provide a heuristic in guiding the development of intervention strategies for improving safety climate. Recommendations on benchmarking management strategy are given.

Meyer, J. (1994). Beyond reason: How to conduct an investigation of organizational and national culture. International Society for Air Safety Investigations, 27(5), 107-118.

A method of conducting investigations of organizational and national culture from a Human Factors perspective was presented in this paper. Human factors were defined by incorporating the Reason and SHEL models. Different from technical investigation, human factors are cumulative, not necessarily observable, using qualitative research methods and content analysis. The format of data collection, analysis, and reporting for airline industry are given. A Forman for Individual Human Factors Analysis, Total Situational Awareness for Flight Deck Crew, and Total Situational Awareness for Air Traffic Control are used to collecting data. Content Analysis Coding Form, and Analysis of Organization Culture are used to analyze the data. A Form for Discussion and Analysis of Human Factors is developed for reporting the results.

Kluckhohn and Strodtbeck identified six questions to define different culture, which are what the perception is of

(1) human nature,
(2) relationship between humans and nature,
(3) time,
(4) activity,
(5) relationship between humans, and
(6) space.

These questions are incorporated into the situational awareness forms.

The Analysis of Organization Culture identifies 10 important aspects for classifying organization cultures:

(1) how the organization's resources are used,
(2) structure of the organization,
(3) measurement systems for safety and safety accountability,
(4) reward systems,
(5) selection and development systems,
(6) response pattern to conflict and problems,
(7) reporting system and feedback system,
(8) organizational norms (shared sayings, doings, feelings, etc.),
(9) organizational policies and procedures compared with other similar organizations,
(10) vision/mission.

Mueller, L., DaSilva, N., Townsend, J., & Tetrick, L. (1999). An empirical evaluation of competing safety climate measurement models. Paper presented at the 1999 Annual Meeting of the Society for Industrial and Organizational Psychology. Atlanta, GA.

The debate of proper safety climate measurement centers on the proper number of factors and the proper number of items for each factor. Different models have emerged from the existing literature. Four different models are discussed in this paper, which are:

Zohar's (1980) 8-factor model:

(1) perceived importance of safety training programs;
(2) perceived management attitude towards safety;
(3) perceived effects of safe conduct on promotion;
(4) perceived level of risk at the workplace;
(5) perceived effects of required work pace on safety;
(6) perceived status of safety officer;
(7) perceived effects of safe conduct on social status; and
(8) perceived status of safety committee.

Brown and Holmes's (1986) 3-factor model:

(1) perceived management concern for the employees' well-being;
(2) perceived management activity level towards safety concerns; and
(3) perceived physical risk.

Dedobbleer and Beland's (1991) 2-factor model:

(1) perceived management commitment to safety; and
(2) perceived worker involvement in safety.

Hoffman and Stetzer's (1995) 1-factor model: safety climate is conceptualized as a single factor variable.

These four safety climate models are tested for their relative plausibility using Confirmatory Factor Analysis. The results support a 4-factor model, quite similar to Zohar's model:

(1) Rewards for working safely,
(2) The effect of safe behavior on social status,
(3) The effect of required work pace on safety, and
(4) Management's attitude toward safety.

In addition, there was evidence that a higher factor may be useful for comparing between organizations, while the 4-factor model is probably more useful for organizational safety diagnostics.

Oliver, J. E., Jr. (1982). An instrument for classifying organizations. Academy of Management Journal, 25(4), 855-866.

Miner's (1979) four limited domain theories identify four parsimonious domains of organizations: hierarchic (H), professional (P), task (T), and group (G). Each of these domains requires different types of behaviors, leaders, decision styles, controls and organization designs. The definitions are given in the form of "ideal types" of organizations.
Based on Miner's four limited domain theories, a 43-item forced-choice instrument, resulting from analysis of a questionnaire containing 100 items and selection of those that best discriminated among domains, was developed and validated to classify organizations and subunits of organizations. The instrument yields a hierarchic score, a professional score, a task score, and a group score, which, taken together, can be used to classify an organization or group into one or a combination of the four domains. The results showed that the four scales developed varied significantly across domains and organizations, as hypothesized.

Perrow, C. (1983). The organizational context of human factors engineering. Administrative Science Quarterly, 28(4), 521-541.

Human factors engineering concerns the design of equipment in accordance with the mental and physical characteristics of operators, but the organizational context limits their influence and restricts their perspective. A model indicating the basic directions of influence in the context of design is presented. The model shows the interactions between management personnel, design engineer, human factors engineer, operator, equipment, and social structure. A discussion of organizational context explains why military and industrial top management personnel are indifferent to good human factors design and shows how the social structure favors the choice of technologies that centralize authority and deskill operators and how it encourages unwarranted attributions of operator error. Different from the traditional technology-social structure paradigm, the equipment and system design could be shaped by organizational structure and top management interests, which in turn could shape operator behavior. Specific system design, therefore, can be chosen deliberately to foster desired social structure and operator behaviors.

Pidgeon, N. F. (1991). Safety culture and risk management in organizations. Journal of Cross-Cultural Psychology, 22(1), 129-140.

Safety culture is defined as an ideational system of meanings concerned with the norms, beliefs, roles, and practices for handling hazards and risk. The role of safety culture in risk assessment and management are discussed. Possible elements of a "good" safety culture are elaborated under three main headings:
(1) Norms and rules for dealing with risk,
(2) Safety attitudes, and
(3) Reflexivity on safety practice.

Pidgeon, N. (1998). Safety culture: Key theoretical issues. Work & Stress, 12(3), 202-216.

The existing literature on safety culture and its relationship to organizational outcomes have remained fragmented and underspecified in theoretical terms. Reasons for this disjunction of theory and practice are discussed. Drawing on existing theories of how organizational accidents occur, four key questions/dilemmas for safety culture researchers are outlined in this article. They include:

(1) The basic paradox of 'safety' culture: the fact that culture serves simultaneously as a precondition both for safe operations and for the oversight of other incubating hazard,
(2) The challenge of dealing with complex and ill-structured hazardous situations where decision makers are faced with deep forms of uncertainty represented by incomplete knowledge or ignorance, specifically, safety cultures which foster risk management strategies based upon the anticipation of all possible hazards may preclude resilient responses should the truly unanticipated actually occur,
(3) The need to consider the construction of risk perception in workgroups, and to view risk acceptability as the outcome of a process of social negotiation, specifically, the incubating danger could be normalized as an acceptable risk, and
(4) The fact that institutional politics and power are critical for determining the achievement of safety culture goals, in particular that of organizational learning, where creative solution is needed to keep balance between accountability and learning.

It is concluded that if these fundamental dilemmas of organizational design are not resolved, the notion of a safety culture may itself become a part of the cycle of organizational failure.

Pidgeon, N. (2001). Safety culture: transferring theory and evidence from the major hazards industries. From website: http://www.roads.detr.gov.uk/roadsafety/research/behave10/06.htm

The origins and development of work on organizational safety culture were outlined. The reasons of theoretical fragmentation of the organizational safety culture are discussed, which include multi-disciplinary origins, different definitions, and different agenda and time scales of practitioner and academic communities. The man-made disaster model of organizational accidents is presented to suggest that organizational culture plays a role in disasters. Approaches to studying safety culture are outlined, together with representative findings from the emerging body of empirical research on the relationship between safety culture and accident outcomes. These include the importance of management commitment to safety, individual attitudes towards violations of rules and procedures, the importance of organizational sub-cultures, and the effects of (and barriers to) attempts at organizational learning from incidents and accidents. Although safety culture has not yet been extensively studied in the context of driver behavior, possible avenues for future research are discussed in relation to fleet safety and the possible transferability of methods and findings from the high hazard context.

Pidgeon, N., & Oleary, M. (1994). Organizational safety culture: Implications for aviation practice. In N. Johnson, N. McDonald, & R. Fuller (Eds.), Aviation psychology in practice (pp. 21-43). Brookfield, VT: Ashgate.

Two theoretical models of large-scale accidents, Turner's (1978) disaster incubation model and Perrow's (1984) complexity-coupling account of failures in sociotechnical systems, are presented to illustrate why many of behavioral causes of disasters should be analyzed using a broader perspective that takes into account the social and organizational arrangements of sociotechnical systems. Safety culture is defined as a system of meaning, which consists of a set of beliefs, norms, attitudes, roles and social and technical practices within an organization, which are concerned with minimizing the exposure of individuals, both within and outside an organization, to conditions considered to be dangerous.
The elements of a "good" safety culture are elaborated under four principle headings:
(1) Location of responsibility for safety at strategic management level,
(2) Distributed attitudes of care and concern throughout an organization,
(3) Appropriate norms and rules for handling hazards, and
(4) On-going reflection upon safety practice.
Finally, the possibility and challenges of the application of the concept of safety culture in guiding the proactive process of institutional design for safety are discussed.

Prakasam, R. (1986). Organizational climate: Development of a questionnaire measure. Psychological Studies, 31(1), 51-55.

Organizational climate is defined as the shared perception of employees regarding the organizational procedures, policies, and practices. In this study, a 50-item 4-point self-administered climate questionnaire was developed for banks and similar institutions. 10 dimensions are covered in this measure:
(1) Conformity,
(2) Sharing in decision making,
(3) Supervision: task orientation,
(4) Supervision: people orientation,
(5) Supervision: bureaucratic orientation,
(6) Responsibility,
(7) Non-financial reward,
(8) Promotion,
(9) Team sprit,
(10) Standard.
Administration of the questionnaire to 48 employees in 4 bank branches and a retest of 44 subjects resulted in favorable item correlation and reliability data. Six out of ten climate dimensions could effectively discriminate the high and low performing branches.

Rahim, A. (1982). Reliability and validity of Likert's profile of organizational characteristics. Journal of Psychology, 112(2), 153-157.

Likert characterizes an organization's style of management into four systems:
(1) Exploitive authoritative,
(2) Benevolent authoritative,
(3) Consultative, and
(4) Participative group.
He distinguished seven key dimensions of organizational climate: motivational forces, leadership, the process of communication, interaction-influence, decision-making, goal-setting or ordering, and control. Likert's (1967) 49-item 8-point Profile of Organizational Characteristics (POC) was developed to measure these seven dimensions and classify organizations into one of the four systems.
In this study, POC, Job Descriptive Index and Personal Reaction Inventory were administrated to 436 college students of business administration who had jobs, to test the psychometric characteristics of POC. Factor analysis showed that the scales of the POC were not factorially independent, the criterion-related validity of the scales and discriminant validity of the items were questionable. Eleven of its 49 items were not free from social desirability bias. Dropping the 11 items that significantly correlated with social desirability and constructing an overall climate scale with the remaining items might solve these problems.

Rakovan, L., Wiggins, M. W., Jensen, R. S., & Hunter, D. R. (1999). A survey of pilots on the dissemination of safety information (DOT/FAA/AM-99/7).

A survey was conducted to obtain information from the pilot population on perceptions of safety-related training currently being offered, its usefulness, and the process through which it might be better disseminated to the general aviation population. The questionnaire assessed the use of safety information, safety awareness, computer/video use, pilot self-assessment of proficiency, demographic information, and stressful experiences. In addition, four open-ended questions were included to allow pilots to freely express themselves on a variety of safety issues. Three sets of analysis were presented for the target group consisting of all private pilots and those commercial pilots who had not flown for hire:
(1) the general demographic and experience data,
(2) comparison on the responses of seminar attendees versus non-attendees,
(3) comparison on the responses of pilots who had been in accidents versus those who had not.
Recommendations to improve the attendance of pilots at FAA-sponsored safety seminars are given.

Reason, J. T. (1993). Managing the management risk: New approaches to organizational safety. In B. Wilpert & T. Qvale (Eds.), Reliability and safety in hazardous work systems (pp. 7-22). Hillsdale: Lawrence Erlbaum Associates.

Three overlapping ages of safety concerns, which are the technical age, the human error age, and the sociotechnical age, are described. In the sociotechnical age, the similar nature of different organizational accidents provides the basic ground for modern theories. A biological model of the organization was presented: analogize the latent failures in technical systems to resident pathogens in the human body, which emphasizes organizations as whole systems; or gestalts, in which there are dynamic interrelationships between people across all disciplines, levels, and functions. A basic structure of the elements of a productive system and the contributions of different system levels to accidents are discussed. A Type and Token model was introduced to classify failure types into two broad groupings. Another classification, namely General Failure Types (GFTs), and corresponding measurement are described. Finally, two kinds of indicators of general failures are discussed.

Reason, J. (1995). Latent errors and systems disasters. In Human error (pp. 173-216). New York: Cambridge University Press.

Reason distinguishes between two types of error: active errors, whose effects are felt almost immediately, and latent errors, whose consequences may lie dormant in a system until such time as they are combined with other factors to breach a system's defenses. Active errors are seen as front line, direct control performance issues (pilots, surgeons, drivers, etc.), while latent errors are seen as generated by those whose activities are removed from the direct control interface (designers, managers, etc.) and are usually present in a system long before active errors are committed (i.e., "resident pathogens"). With advances in technologies and expectations, Reason argues that many times, the system sets up the end user for failure, due to such built in problems as increased automation, system opacity, etc. He includes case studies from notable accidents where latent failure was found at the root of the accident (e.g., Three Mile Island, Bhopal, challenger, etc.). Five basic elements of a production system as an overview of accident causation are identified as:

(1) High-level decision makers set goals for the system and can make fallible decisions that may result in an accident down the line. (Latent)
(2) Line management implements the strategies set forth by the decision makers and may also execute fallible decisions. (Latent)
(3) Preconditions such as environmental factors, workforce, work schedules, knowledge, etc. can set the stage for desirable or undesirable performance. (Latent)
(4) Productive activities is the actual integration of humans and machines generating an output, which can lead to success or failure. (Active)
(5) Defences (sic) which are safeguards against foreseeable hazards may sometimes be inadequate. (Active and Latent)

Reason models a trajectory of opportunity for unsafe acts to breach a system's defenses. The trajectory originates at higher levels of the system (such as managerial) and passes through preconditions and unsafe acts via local triggers, intrinsic defects and atypical conditions. While it is unlikely that any one set of causal factors can complete a trajectory, the window of opportunity on each layer of the system is influenced by largely unpredictable intrinsic and extrinsic factors which vary over time in both size and location. For safer operations, Reason discusses prerequisites for adequate control including a sensitive, multichannel feedback system and the ability to respond rapidly and effectively to actual or anticipated changes in a system.

Roberts, K. H. (1990). Some characteristics of one type of high reliability organization. Organization Science, 1(2), 160-176.

As an example of High Reliability Organizations, nuclear powered aircraft carries were used to defining organizational processes necessary to operate safely technologically complex organizations that can do great physical harm to themselves and their surrounding environments. A set of components of "risk" identified by Perrow (1984) and antecedents to catastrophe elucidated by Shrivastava (1986) were described. How carriers deal with these factors to lessen their potentially negative effects was discussed. Suggestions for future research are also given.

Rogers, E. D., Miles, W. G., & Biggs, W. D. (1980). The factor replicability of the Litwin and Stringer organizational climate questionnaire: An inter- and intra-organizational assessment. Journal of Management, 6(1), 65-78.

The Litwin and Stringer Organizational Climate Questionnaire (LSOCQ) is one of the most widely used, perception-based climate instruments. This 50-item instrument is designed to tap a priori scales that are suggested to measure the separate dimensions that constitute organizational climate. The nine scales are defined as:
(1) Structure,
(2) Responsibility,
(3) Reward,
(4) Risk,
(5) Warmth,
(6) Support,
(7) Standards,
(8) Conflict, and
(9) Identity.
In this study, four factor analytic studies of LSOCQ are compared to assess the consistency of the instrument's factor structure when administered to different organizational populations. In addition, separate factor analytic results of the LSOCQ for 3 functional subgroups of a single organization are compared to investigate the LSOCQ's factor consistency within a single organization. The results show that the nine a priori scales do not represent separate, independent dimensions of organization climate, and there is no consistent factor analytic structure across different organizations, or even across different functional subgroups within a single organization. The authors conclude that the LSOCQ is situation or organization specific, instead of being consistent across organizations.

Rollenhagen, C. (1999). Organizational factors: their definition and influence on nuclear safety. A framework for assessment of organizational characteristics and their influences on safety (ERB FI4S-CT98-0051).

Two different analytical strategies in understanding the influence of human and organizational factors on safety, namely, top-down and bottom-up approaches, and their associated advantages and disadvantages are discussed. A bottom-up conceptual model about organizational factors related to safety was developed. This model is anchored in three fundamental conceptual categories: activities, resources, and the technological core system. The model also contains a top-down perspective, which is represented by two abstract organizational dimensions, the degree of integration and the degree of formalism. An extended model that takes into account the external influences is also presented. Some specific assessment methods are illustrated by the example of the Swedish nuclear industry.

Rybowiak, V., Garst, H., Frese, M., & Batinic, B. (1999). Error orientation questionnaire (EOQ): Reliability, validity, and different language equivalence. Journal of Organizational Behavior, 20(4), 527-547.

Error orientation is conceptualized within a general coping concept, which is related to how negatively errors are perceived, the degree to which one anticipates that errors will happen, and how to cope with errors. Two studies were conducted to develop and validated an Error Orientation Questionnaire (EOQ), which was designed to assess attitudes to and on, coping with errors at work. In study 1, with a representative sample from Germany, 6 scales were developed with the help of a confirmatory factor analysis using LISREL techniques. They comprise error competence, learning from errors, error risk taking, error strain, error anticipation, and covering up errors. All constructs were validated. In study 2, items were added to the scales and two additional scales, "error communication" and "thinking about errors," were included. A final version of the 8-factor instrument was therefore established. The scales were translated into English and Dutch, and administrated to bilingual students from Netherlands. The 8-factor solutions in English and Dutch were replicated. The results suggested that there is some equivalence across languages; the mean difference should not be interpreted, but correlational differences can be interpreted. Finally, the practical value of the EOQ was pointed out.

Sanders, J., Hamilton, V. L., & Yuasa, T. (1998). The institutionalization of sanctions for wrongdoing inside the organizations: Public judgements in Japan, Russia, and the United States. Law & Society Review, 32(4), 871-929.

This study reviewed different cultural responses (workers in Tokyo, Moscow, and Washington) to wrongdoing and sanctions for wrongdoing. A goal of this research is a better understanding of how complex organizational law structures interact within different cultures. Workers' views of sanctioning reflect cultural differences in conceptions of the individual, the organization, and the law. Through studying attributes of responsibility, this research may enrich the larger context of normative cultural approaches to the study of organizations. By focusing on corporate wrongdoing, this research offers a view of important components of institutional arrangement: how the organization is set up to respond to deviance.
The researchers distributed surveys with various vignettes of wrongdoing inside organizations. Each vignette manipulated three variables: mental state of the principal actor (intentional action, negligence, or accidental harm), the actor's position within the hierarchy (subordinate, mid-level authority), and the influence placed on the actor (acting alone, acting under orders, acting collectively).

Schriber, J. B., & Gutek, B. A. (1987). Some dimensions of work: Measurement of an underlying aspect of organizational culture. Journal of Applied Psychology, 72(4), 642-650.

This study examines the existence of temporal dimension norms in organizational culture and developed an instrument to measure the dimensions as a means to study cross-organizational and intra-organizational comparisons. The authors contend that norms of time can be viewed as characteristics of culture such tat differences among cultures should lead to differences among views and assumptions about time (e.g., do meetings start on time, is the boss always late, are employees prompt, are deadlines adhered to, etc.). Norms can prescribe sequential rigidity and facilitate conformity. Rigidity and conformity to temporal dimensions provide necessary behavioral control when complex, multiple goals can only be attained through coordinated activity. The temporal aspects of norms guide behavior to increase individual rewards and decrease costs associated with interactions.
The authors developed a Likert scale of 56 items describing time related behaviors, situations and customs regarding the allocation of time, routine, and coordination, among others, to measure workers' perceptions of 15 separate temporal dimensions or norms. The analysis extracted 13 usable scales: Time boundaries between work and non work, sequencing of tasks, punctuality, allocation, awareness, synchronization and coordination, variety versus routine, intra-organizational time boundaries, future orientation, schedules and deadlines, work pace, autonomy of time use, and quality versus speed. Two hypothesized scales regarding buffering did not emerge as factors. The application of these scales can result in rich descriptions of organizational or departmental cultures and can establish a basis for comparison between organizations or subunits (e.g., homogeneity or heterogeneity, variance among hierarchies, importance of punctuality, disparity between organizational norms and personal norms as a predictor of withdrawal behavior or career success, morale, etc.). These scales may also be employed as part of a planned change effort.

Sheffield. (1981). Organization climate. In I. Cook (Ed.), The experience of work (pp. 219-225). San Diego, CA: Academic Press.

This book chapter provides a very concise outline of 26 organizational climate measurements. The author describes the history and development of each measure. The various components of organizational climate that are assessed by each measure are described. Areas in which each measure has been applied within industry is discussed. Where available, a discussion of the validity of the individual measures is also provided.

Simpson, P., & Beeby, M. (1993). Facilitating public sector organisational change through the processes of transformational leadership: A study integrating strategic options development and analysis with the cultural values survey. Management Education and Development, 24(4), 316-329.

A UK study regarding change management as it applies to legislative change and societal demands in the public sector which is more noted for bureaucracy rather than adaptability. The authors claim that the psychology of an individual and relationships within teams are key aspects of transformational processes and culture change, focusing on the team and organization process. The authors describe their approach to intervention that encourages attention to all of the factors associated with transformational leaders, without the need for a single individual, with so-called leader's intuition, to possess the associated behavioral traits or qualities, which consist of:

(1) Developing an initiating vision, articulated in such a way as to capture the attention of organisational members
(2) Communication of the significance of what the organization seeks to attain
(3) Continuous development and redevelopment of the initial vision that successively incorporates the negotiated visions of change movers, and,
(4) The process of developing negotiation leading to consensus and commitment.

Twelve in-depth interviews were conducted with senior public sector managers recently responsible for the implementation of major change projects (published as a separate study). The research consisted of semi-structured recorded interviews using the "Personal Best Leadership Experience Worksheet" (Kouzes & Posner, 1990). The content of these interviews was analyzed forming the basis for a critical re-examination of the core conceptual framework in Kouzes and Posner's, "Practices of Everyday Leaders." Based on their experience with the previous data, a model is summarized as a guide to managing and effecting significant change, providing an opportunity for team members to explore the fit between culture and strategic position.

Tait, R., & Walker, D. (2000). Motivating the workforce: The value of external health and safety awards. Journal of Safety Research, 31,(4), 243-251.

This paper looks at the prevalence of external health and safety award schemes currently in use at companies in the United Kingdom. Response data to questionnaires is presented on the benefits that motivate participation in these schemes. Evidence suggests that service industries and small businesses generally show little interest in awards or incentives. Among companies that do not employ award or incentive schemes, concentration centered on good employee communications through health and safety training, company newspapers, posters, and video presentations. This research also demonstrated that the majority of organizations do not enter award competitions to motivate workers, thereby improving health and safety standards. Rather, the motivation is based on obtaining a record of achievement or an acknowledgement of standards already attained. This recognition from reputable, independent, external sources is seen as a powerful tool not only to motivate individual employees, but also to gain recognition as an aid to company activities, enhancing company image and reputation.

Thacker, J. (1994). Organizational cultures: How to identify and understand them. Educational and Child Psychology, 11(3), 11-21.

The author explores the meaning of organizational culture as it applies to education, specifically, guiding beliefs and expectations in operations particularly how people relate or fail to relate to each other. Culture resides mainly in the taken for granted. One way to access a culture is to study its symbols through such means as language, paperwork (or lack thereof), relationships. Culture is seen as composed of different interacting layers (based on Schein, 1985):

(1) Artifacts and creations which are visible but often at the level of espoused theories (outward manifestations, high profile symbols),
(2) Values shown through behavior which have some awareness, but at the level of theories in action (routine responses, values, norms),
(3) Mind sets – basic assumptions which are taken for granted and largely invisible, though they can be articulated (nature of reality, time , space, relationships), and
(4) Heart sets which are mostly unconscious (emotional states and needs).

Cultures are also likened to Greek gods (based on the work of Charles Handy, 1991), such as Zeus (a spider web) a patriarchal culture where the key to the organization sits in the center, or Dionysius (a constellation of stars loosely gathered in a circle) where people describe themselves as doctors or lawyers, rather than where they work. The dual nature of culture is discussed as simultaneously being a force for stability and an impediment to change. However, when managed properly, culture can be a force for change. Thacker discusses the process of "surfacing the culture" by facilitating a series of cycles of group activity through introducing ideas of organizational culture, generating data on the culture, making sense of the data and identifying key themes, and planning further data collection. Thacker then outlines what he calls a three way analysis to help groups wanting to move toward change:

(1) Re-affirm and safeguard core values
(2) Discard no longer relevant practices
(3) Create a window of opportunity for change. Expand the range of possibilities by brainstorming or other ideas-producing methods.

Verbeke, W., Volgering, M. & Hessels, M. (1998). Exploring the conceptual expansion within the field of organizational behavior: Organizational climate and organizational culture. Journal of Management Studies, 35(3), 303-329.

The goal of this study was the investigation of how concepts within the field of organizational behavior expand over time. The expansion of scientific concepts was discussed relative to two theories. The first is that conceptual expansion is constrained by consensus generating scientific practices. The second ("everything goes") is that conceptual expansion occurs because the field consists of speech communities loosely expanding the field without a core concept. The authors employed content analysis and statistical analysis to learn how organizational climate and organizational culture have developed over time. Conceptual expansion of organizational behavior appears to be constrained rationally, which is to say variations in the fields emerge around a core concept.

The authors also offer a short history of the development of organizational behavior studies. Noting that organizational climate originated in Gestalt psychology, which suggests a person is a function of his environment, both the person and the environment have to be defined. Organizational culture originated with symbolic interactionism, requiring a social unit and a shared experience. As a concept, organizational climate has a longer history, yet some scholars suggest that organizational culture captures richer and different dimensions of the organization. Some scholars suggest that these concepts are not mutually exclusive and should be merged with one another, incorporating traditions of climate research with cultural literature to apply to future research. Others suggest the two topics should remain separate entities, although they bear similarities.

Wallin, L. (1987). Modification of work organization. Ergonomics, 30(2), 343-349.

The significant effects of work organization on occupational health and well-being were reviewed. It was suggested that changes in work organization must be carried out on the basis of detailed knowledge of the work process, the tools, and the product; and must take into account how the personnel involved, experience the way in which their needs are respected and satisfied at work. A method of assessing the effect of work organization on health, which was based on the value of involving the entire workgroup in the process of change, was described. This method consisted of questionnaires on the attitude to the physical work environment, health, and psychological work factors, interviews, clinical evaluations, and objective assessments of the physical work environment. Factor analysis of the questionnaire showed that it covered four main areas (physical environment, medical symptoms, psychological stress, and job satisfaction), and 25 sub-factors. A comparison of the profile of a work group of seven white-collar workers before and after the change of work organization showed that a much more positive situation both in the physical and the psychological work environment was resulted from the change. It was suggested that this method could provide a starting point from which the group and management can take actions to improve the work environment.

Waters, L. K., Roach, D., & Batlis, N. (1974). Organizational climate dimensions and job-related attitudes. Personnel Psychology, 27, 465-476.

Two questions were addressed in this article: what are the dimensions of climate, and whether the perceptions of aspects of climate related to either objective or subjective indices of individual behavior in, or attitudes concerning, the organization. To answer the first question, a factor analysis was conducted using 22 perceptually based organization climate scales adapted from 3 questionnaires developed by N. Margulies; G. H. Litwin and R. A. Stringer; and R. J. House and J. R. Rizzo. The 22 scales measured disengagement, hindrance, esprit, intimacy, aloofness, production emphasis, thrust, consideration, structure, responsibility, reward, risk, warmth, standards, support, conflict, identity, conflict and inconsistency, formalization, adequacy of planning, selection based on ability and performance, and tolerance of error. A five-factor solution, consisting of the following was found most significant:
(1) Effective organizational structure,
(2) Work autonomy vs. encumbered by nonproductive activities,
(3) Close impersonal supervision,
(4) Open challenging environment, and
(5) Management and peer support or employee centered orientation.
To address the second question, the factor analysis dimensions were related to 105 radio and TV employees' subjective reports of satisfaction, involvement, intrinsic motivation, effort, and performance. The results revealed that factor 5 was significantly related to all the job attitudes except self-rated effort and performance. Factor 1 was most salient in satisfaction with interpersonal relationships and opportunities for recognizable advancement. Factor 2 was most related to job involvement, and factor 4 was most related to intrinsic motivation and satisfaction with task-involved self-realization. The findings provide evidence that various climate dimensions are differentially related to several job-related attitudes.

Weick, K. E. (1987). Organizational culture as a source of high reliability. California Management Review, 29(2), 112-127.

For organizations that the major learning strategy of trial and error is not available, an unconventional means by which organizations achieve high reliability was explored. The point was that people needed 'requisite variety' to cope with complex systems, otherwise, they would miss important information, and make incomplete diagnoses and shortsighted remedies. In this sense, the traditional way to achieve high reliability, namely training, could in fact create errors. It is suggested that one way to match the variety of complex systems was by networks and teams of divergent individuals. The collective requisite variety could be enhanced by effective delegation of responsibility, high level of trust and face-to-face communication. Another way to achieve high reliability was to take a more dynamic view of reliability and employ appropriate reward structures where high reliability gets more incentives. To achieve high reliability, people should enact their environment. Reliability requires centralization and decentralization, and it is suggested that culture could make both occur simultaneously. The author argued that story telling is an effective way to establish reliability culture, and a system which values stories, storytellers, and storytelling will be more reliable.

West, D., & Berthon, P. (1997). Antecedents of risk-taking behavior by advertisers: Empirical evidence and management implications. Journal of Advertising Research, 37(5), 27-40.

Advertising risk was defined, and the antecedents of risk-taking behavior by advertisers and the circumstances that increase the propensity to take risks were examined. Drawing on Prospect Theory and the wider literature on risk in management decision making, a model of risk taking in advertising was developed. Three specific antecedents were considered: company culture, company performance, and organizational processes. The interactions between culture and performance as well as culture and process were also considered to influence the risk taking behavior in advertising. Data from a mail survey of senior marketing directors in the US and Canada indicated that performance and the interaction between culture and performance both had a significant impact on managers' risk-taking propensity in most recent advertising campaign, and process and the interaction between culture and process also had a significant impact on manager's risk-taking propensity in future advertising campaign. All the relationships were in the same direction as predicted. Companies with on-or-above target performance tended to be more risk averse than those with below target performance, but the on-or-above-target firms become risk seeking for high levels of risk culture. Companies with top-down decision processes tended to be less risk averse than those with bottom-up decision processes, but firms with bottom-up processes became risk seeking for high levels of risk culture. The comparison of two regression models also suggested that past behavior is constrained by past performance, while future behavior is constrained by the decision-making process. Based on the findings, the circumstances where testing and planning were appropriate for risk management were described.

Wilpert, B. (2000). Organizational factors in nuclear safety. Paper presented on the PSAM 5 Conference, Osaka.

Various current modeling approaches on organizational factors were reviewed. It is suggested that all the approaches belong to three groups:

(1) Functional models, which list mainly functional elements, but occasionally add a few structural ones as well, including US-NRC, Swiss, OECD/NEA, HSE, Finnish, ASCOT;
(2) Event analytical models, which are used in incident analysis, including TOR, SOL, CREAM, and TRIPOD; and
(3) Generic process models, which focus strictly on the dynamic aspects, including SKI and Rollenhagen.

Based on the review, a conceptual heuristic framework that differentiates technology from four different social subsystems: individual, team, organization, and extra-organizational environment was proposed. Permanent organizational learning is seen within this framework as an essential in order to ensure the system output: safety and reliability. An input-output model was also presented. Finally, three major strands of theorizing about organizational aspects and system safety, which are the pessimistic view, the optimistic view, and the organizational cultural approach, were summarized. The author concluded that theoretical advances are essential in order to advance in the necessary development of methodical approaches to assess the impact of organizational factors.

Wilpert, B., Miller, R., & Wahlstrom, B. (1999). Organizational factors: Their definition and influence on nuclear safety. Report on needs and methods (AMM-ORFA(99)-R03).

First, general organizational strategies for the assessment of organizational performance were reviewed, which included quality systems, activity planning, performance appraisals, organizational restructuring, business process re-engineering within the organization, safety committees, exchange of good practices, regulatory framework, safety culture, probabilitistic safety analysis, peer reviews, incident analysis, performance indicators, assessments of the organizational climate, self-assessments, and certification. This was then followed by a review on 13 models of organizational factors, including NRC, Swiss, OECD/NEA, HSE, Finnish, SKI, Rollenhagen, ASCOT, SOL, CREAM, TOR, TRIPOD, and OHN. Then, using the 'meta-plan' method, 7 general categories were identified:
(1) Interorganizational relations,
(2) Vision, goals and strategies,
(3) Supervision and control,
(4) Operation management,
(5) Resource allocation,
(6) Performance, and
(7) Technology.
An input-output model was proposed to summarize the potential interrelations among the seven categories and their influence on nuclear plant outcomes. Finally, a survey on needs and methods for NPPs and regulators, which consists of 9 questions about assessment of organizational performance, was drafted.

Yule, S. J., Flin, R., & Murdy, A. J. (2001). Modeling managerial influence on safety climate. Poster presented at SIOP Conference. San Diego.

Safety climate was conceptualized as the product of employee perceptions and attitudes about the current state of safety initiatives at their place of work. A review on published models of safety climate suggested that management has important influence on safety culture. This study attempted to model the managerial influence on workforce safety climate. Safety climate was measured by HSE Climate Survey Tool, which is a 71-item, 5-point Likert scale. Factor analysis of the questionnaire identified eight factors. A model was proposed based on the result of factor analysis. In this model, two layers of management, team leaders and upper management, were identified. It was proposed that different levels of management have differential effects on the other factors of safety climate. The model was tested and re-specified using Structural Equation Model (SEM). The resulting model supported most hypothetical paths, and added some new ones as well. The model provided a foundation for identifying and exploring the important influence on safety climate.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. Journal of Applied Psychology, 65(1), 96-102.

The organizational features shared in low-accident companies were reviewed. Based on this review, a 5-point safety climate questionnaire was developed, which consisted of seven organizational dimensions and 49 items. The analysis of the pilot testing of this questionnaire resulted in an 8-factor 40-item measure of perceptions of organizational safety climate, which are:
(1) Importance of safety training programs,
(2) Management attitudes toward safety,
(3) Effects of safe conduct on promotion,
(4) Level of risk at work place,
(5) Effects of required work pace on safety,
(6) Status of safety officer,
(7) Effects of safe conduct on social status, and
(8) Status of safety committee.
The resulting questionnaire was then constructed and validated in a stratified sample of 20 workers from each of 20 industrial organizations in Israel. This measure of climate reflects employees' perceptions about the relative importance of safe conduct in their occupational behavior. It can vary from highly positive to a neutral level, and its average level reflects the safety climate in a given company. It is shown that there was an agreement among subjects' perceptions of safety climate in their company. The level of this climate was then correlated with safety program effectiveness as judged by safety inspectors. The 2 dimensions of highest importance in determining the level of this climate were subjects' perceptions of management attitudes about safety and their own perceptions regarding the relevance of safety in general production processes. It is proposed that organizational climate, when operationalized and validated as demonstrated in this article, can serve as a useful tool in understanding occupational behavior.

Zohar, D. (2000). A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. Journal of Applied Psychology, 85(4), 587-596.

Taking a levels-of-analysis perspective, a group-level model of safety climate was derived from the existing organization-level model. Climate perceptions in this case are related to supervisory safety practices rather than to company policies and procedures. A newly developed 5-point 10-item questionnaire was used to measure safety climate perceptions on group level for 53 work groups in a single manufacturing company. Factor analysis identified 2 factors in this questionnaire: supervisory action and expectation. The results revealed both high within-group homogeneity and between-groups variation, which justified considerations of subscale scores of safety climate perceptions. To test the predictive validity of this questionnaire a new objective outcome measure, microaccidents, which refers to behavior-dependent on-the-job minor injuries requiring medical attention, was employed. The results showed that climate perceptions significantly predicted microaccident records during the 5-month recording period that followed climate measurement, when the effects of group- and individual-level risk factors were controlled. In summary, the results of this study offered empirical support for three validation criteria of safety climate as a group-level construct: within-group homogeneity, between-group variance, and predictive validity. Therefore it was suggested that safety climate perceptions could develop at the subunit level of organizations in parallel to their previously demonstrated development at the organizational level. The implications of these findings were discussed.

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