A Patchwork of Contradictions and Confusions: Inside the Software Industry

Merrelyn Emery

January 2023

In 2021 a series of conversations took place in which concerns were raised about the software industry and what was happening to personnel in various sections of it. One of those concerned had learnt of Open Systems Theory with its genotypical design principles underlying organizational redesign and wondered whether such an option could help with analysis or present a solution if such was required. That one was Trond Hjorteland and my thanks go to him. He not only initiated these discussions, he started diffusing the concepts and involving others. He also did all the technical work on the survey to make it possible. His efforts also led to an introduction to OST course being held in Canberra. None of that would have been possible without him.

The result of these discussions was the design and administration of a survey customized to the software industry. It explored two main lines of enquiry, the first detailing what was going on inside the software industry with a comprehensive set of questions covering critical dimensions of both human and organizational features and behaviours. The second concentrated on the state of knowledge about, and acceptance of, redesigns for organizations based on the second genotypical design principle, redundancy of functions. This entailed investigating attitudes towards change in general and towards organizations with "a legal structure composed of self managing groups from bottom to top where the members of the group worked towards group goals with shared responsibilities" in particular.

This paper reports on the first line of enquiry.

Conceptual framework

The conceptual framework for this study is known as open systems theory (OST), the origins of which stretch back into time but in the modern era is associated with the completion of the open system by Emery and Trist 1965. They did this by defining the social or organizational environment or extended social field of directive correlations shown in Figure 1 as the $L_{22.}$

This environment refers to “those processes in the environment itself which are among the determining conditions of the exchanges (between system and environment)” (Emery and Trist 1965 p54) that part of the open system Bertalanffy (1950) left undefined. It is now defined as the “processes through which parts of the environment become related to each other, that is, its causal texture – the area of interdependencies that belong within the environment itself” (Emery and Trist 1965 p54). They also outlined changes in its causal texture over time.

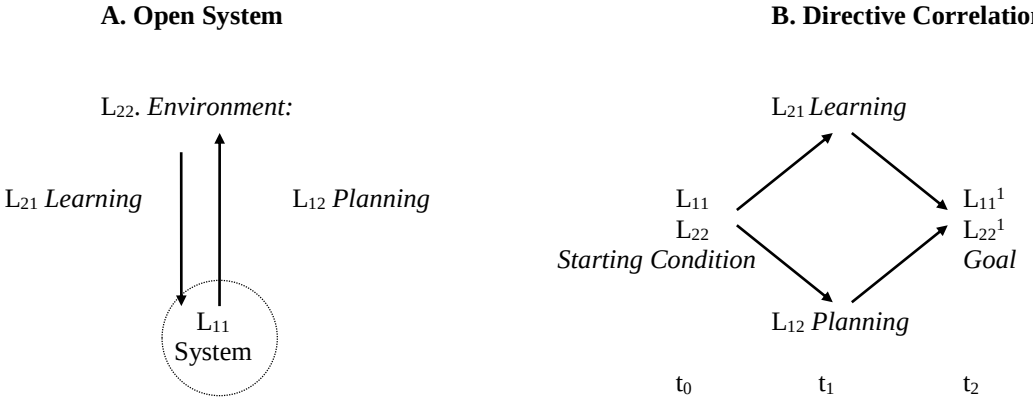


Figure 1. The Basic Models of Open System and Directive Correlation

The basic open system (Figure 1A) expresses the view that system, environment and their interrelations are governed by laws (L). A system (1) acts upon the environment (2), the planning function (L_{12}). Environment acts upon the system and is known to us through learning (L_{21}). L_{11} and L_{22} express the intrinsic nature of the system and environment respectively.

Figure 1B shows the original condition at t_0, which consists of the system and its environment, where both system and environment are making changes at t_1. These result in a new set of conditions consisting of a changed system and a changed environment at t_2. In this case, the changes are directively correlated and, therefore, adaptive.

In Figure 1, the two models show how system and environment act jointly to produce a new one. The critical differences between the two models are that:

- the open system is a picture of a point *in time* with change expressed through learning and planning, while the directive correlation is a picture *over time*;
- the open system includes adaptive and maladaptive relations, while the directive correlation expresses precisely when adaptation is or is not occurring

Using open systems creates a quite different social science to the more common closed systems variants, one based on material rather than abstract universals (Emery M 2000).

The genotypical organizational design principles

A major conceptual strand within OST has been the development of efficient and effective organizational redesign using the genotypical design principles.

These design principles were discovered by Fred Emery (Emery F 1967) while working on the Norwegian Industrial Democracy Program (Emery and Thorsrud 1976). After this discovery, the world of organizational design and change would never be the same again. The design principles explained and simplified the decades of research on which they built and led to radical changes in both theoretical and methodological developments. Neither Emery nor Thorsrud ever used the previous old 9 step method again.

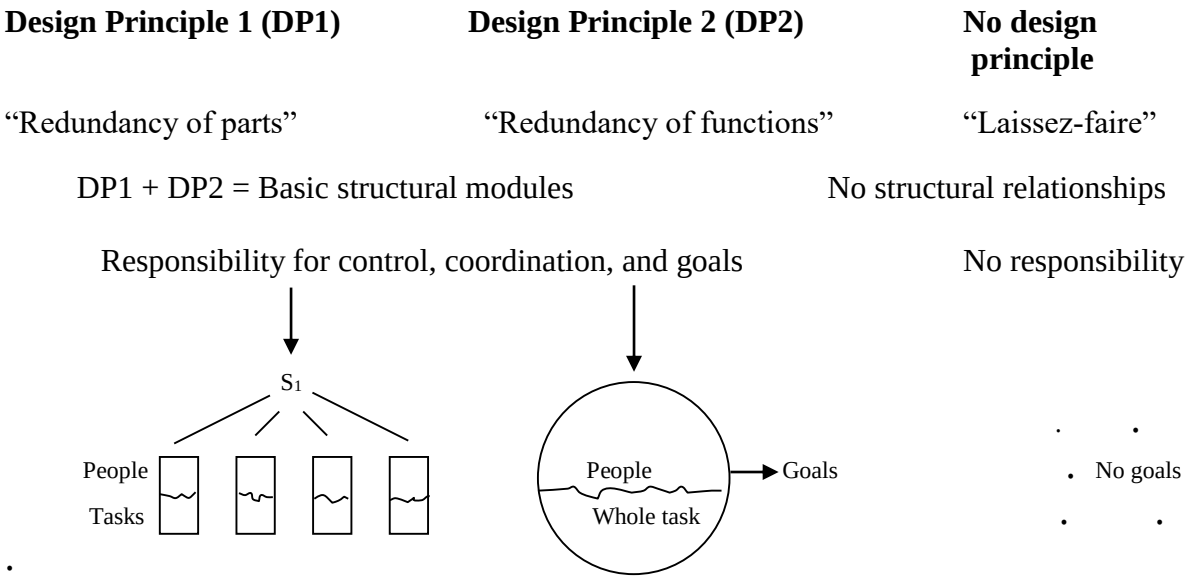
The radical change in methodology arrived with the design of the Participative Design Workshop which heralded in a continuing era of quick, effective organizational change embodying a change of genotypical design principle (Emery & Emery 1974).

In DP1 (Figure 2), responsibility for coordination and control, the two dimensions of organizational structure, is located at least one level above the action. Therefore, the DP1 organization is autocratic or bureaucratic. It is the master-servant relation in action where those above have the right and responsibility to tell those below what to do and how to do it. It is a structure of personal dominance, a dominant hierarchy.

As Figure 2 shows, the basic module of a DP1 structure is a section consisting of individuals with a supervisor (S1); one person one job where only S1 has responsibility for coordination, control and goal setting. The dynamics of a DP1 structure are well established: to get ahead in DP1, one must compete. As soon as people are forced to compete, they have to look after their own interests, and self-interest comes to dominate life in a DP1 structure. Years of exercises such as team-building have shown they cannot change this dynamic.

In DP2, responsibility for coordination and control is located with the people performing the task. The self-managing group, previously called semiautonomous (F. Emery, 1980), works to a comprehensive set of agreed and measurable goals. Large DP2 structures are non-dominant hierarchies of function where all change is negotiated between peers.

Genotypical Design Principles and Psychological Requirements for Productive Work



Note: S_1 = first-line supervisor.

Figure 2: Genotypical Organizational Design Principles

DP2 has markedly different potentials than DP1. Rather than individual jobs, the whole group is now jointly responsible for every aspect of the task. Because they are working together to achieve agreed goals for which they are collectively responsible, it engenders cooperation. DP2 structures feature the creative working mode.

Over time DP1 deskills and demotivates, DP2 skills and motivates. DP1 causes dependency, fight or flight, pairing (Emery M 1999) and amplifies communication problems

and personality conflicts (Emery and Emery 1976; Emery M 2004). These design principles also appear to operate across the animal, biological or cellular and mechanical realms (Emery M 2003).

The third option first identified as a laissez-faire social climate (Lippitt 1940) is in pure form a lack of design principle and, therefore, a lack of structure as there are no structural relationships between the people (Emery M 2006). This is merely a collection of people each 'doing their own thing'. More commonly, a form of organization has been identified, predominantly in North America which approximates laissez-faire while officially DP1 on paper (Emery and deGuerre 2007; deGuerre and Emery, 2008). The modern forms feature a supervisor called a trainer, leader or coach (TLC) with a 'team'. In the interests of 'empowerment' and/or 'participation', controls have been loosened to give the impression of autonomy and in most cases, the TLC will be expected to conform to human relations principles of warm and friendly comunications. However, the design principle has not been changed and frequently the result is confusion as pseudo autonomy conflicts with the S1's responsibilities. Workers often prefer this form as it can provide greater autonomy, until things go wrong when the legal design principle kicks back into life.

The design principles are also major determinants of intrinsic motivation measured by the psychological requirements for productive work, or the “6 criteria” (Emery and Thorsrud 1969). It is difficult to get good scores on the 6 criteria from DP1 structures, even when people appreciate their extrinsic motivators, their good hygiene factors. Norway deemed the 6 criteria sufficiently important to encode them into their work environment law in 1977 (Gustavsen 1987).

The six criteria are:

1. Elbow Room, optimal autonomy in decision making
2. Continual Learning for which there must be
   (a) some room to set goals
   (b) receipt of accurate and timely feedback
3. Variety
4. Mutual Support and Respect, helping out and being helped out by others without being asked, respect for contribution rather than IQ for example
5. Meaningfulness which consists of
   (a) doing something that society values
   (b) seeing the whole product or service to which the individual contributes
6. A desirable Future, not having a dead end job. (Adapted from Emery & Emery, 1974)

Similarly, DP1 structures amplify, while DP2 structures attenuate errors (Beer 1972 in Emery F 1977) so only DP2 produces an organization “structured in such a way that its members can learn and continue to learn within it” (Emery M 1999 p. 20). There is no implication here that organizations can learn.

The design principles operate throughout society, underlying political or governance systems in the same way as single organizations of all types. DP1 yields representative structures, DP2 alternatives are available (Emery F 1974, 1976a, 1976b, 1989).

DP2 is critical to active adaptation because only ideal seeking provides the unitary direction required for a directive correlation and “it is only within group life that ideals emerge” (Emery F 1977, p. 79). When people work in DP2, they treat their organizations as instruments to achieve the common good.

Table 1 shows the conceptual and language changes over time as the design principles have revolutionized both theory and practice. The three options form a complete set. If there

is responsibility for coordination and control then it is either held by the actors or it isn't. If there is no responsibility for coordination and control, there is no design principle and, therefore, laissez-faire.

Table 1. Conceptual and language changes since discovery of the design principles		
Autocratic social climate	Democratic	Laissez-faire (Lippitt 1940)
Non jointly optimized socio-tech*	Jointly optimized	Neither (Trist and Bamforth 1951)
DP1 structure	DP2 structure	No design principle No structural relationships

* Where sociotechnical includes sociopsychological and socioecological

Constructed scales

As part of the development of OST in its work on organizations, about twenty years ago we created a comprehensive questionnaire and database of survey data from organizations looking for reasons for their shortcomings and to find solutions. That instrument has been adapted to the case of the software industry to provide comparable data from a diversity of organizations.

The questionnaire contains a series of questions which constitute formula to permit us to accurately measure critical dimensions of organizational function (Appendix A). There are formula for each of the design principles and laissez-faire, plus measures of the intrinsic motivators. The other standard items are Bion's two major basic group assumptions of dependency (baD) and fight/flight (baF) and the creative working mode (CWM), Bion's W for work group (Bion, 1952, 1961) . Each formula precisely reflects the theory of these constructs. Each application of the instrument includes these standard formula to ensure comparable data on the basics.

In addition to these standard formula, there are other constructed scales based on well established and powerful indices of personal and organizational function. These may vary in each administration as different organizations have different requirements but there is always a hard core of questions on which to base comparability. These indices include such constructs as the positive and negative affects, intellectual satisfaction, health, organizational performance and extrinsic motivators.

Agile: from the frying pan into the fire.

The origins and development of agile leave no doubt as to what problem they were trying solve. Tracing back to the 1930s with the very beginnings of 'lean' and then to 1993 when Sutherland invented a new faster method of development, 'scrum', made public in 1995, and as software was becoming ubiquitous, 17 'organizational anarchists' met to share ideas about future developments. This resulted in the *Agile Manifesto*, a statement of four principles. These principles are:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

"From 2001 on, all development frameworks that aligned on these principles would be known as agile techniques" (Rigby et al 2016). Later 12 operating principles were added and the Agile Alliance was set up.

The organizational anarchists who wrote the agile manifesto were 'technologists' attempting to improve their own work. There is little evidence of influence from any contemporary social science and certainly no evidence that Winby's (2022) fourth generation of design which includes agile was influenced in any way by complex adaptive systems or sociotechnical systems (STS). Perhaps other contemporary approaches use these theories but agile appears not to. If there had been learning from STS, particularly its form since 1967-1974 which Winby ignores, agile would be more adaptive, avoiding many of the problems with which it is bedevilled today.

The problem the technologists were trying to solve was the time consuming, detailed and inflexible mechanical planning and development processes used in conventional DP1 structures for writing and testing software. This method called 'waterfall' going back to Henry Ford, was designed to produce standardization and reliability but was increasingly out of tune with the times. Practitioners wanted methods designed for flexibility and adaptability where each individual takes responsibility for their own work. Rather than planning and documentation they wanted iterative development with quick deployment, responsiveness to change and emphasis on customer needs (Fuchs and Hess 2018).

The core of the problem which was defined as 'structure' was solved by removing what they thought was the 'structure'. Initially, the solution to this problem elicited positive responses by employees freed of the constraints of what we now know of as DP1 structure. Identifying 'structure' as the problem is typified in the following: "Our organizations were less structured" and "people on agile teams are typically more productive and happier" (Sacolick 2022).

These quotes demonstrate that right from the beginning of the agile movement it can be seen that the prevailing philosophy was individualism.

Individualism is again apparent in the emphasis on 'autonomous' teams. Missing is the essential organizational ingredient of relationship between teams and any awareness of interdependence for coherent organizational responses. It should be obvious that not all organizational goals or functions can be devolved to or inhere in single teams and it is consequently no surprise that one of the most common problems identified with agile below is the lack of coordination.

Similarly, the autonomous teams are multifunctional but not multiskilled so that people cannot share the various bits of work around. Throughout the agile literature we find one person one job as in Scrum where there are three team roles, product owner, scrum master and the development team (59 seconds no date). Not only are these teams one person one job, they also contain a hierarchy. Rather than avoid a dominant hierarchy they have continued with some of its worst features. They have not removed the 'structure' identified as the obstacle, only varying degrees of supervision, and clearly, without knowledge of the design principles, people are destined to repeat the same mistakes with little apparent source of rectification.

At Spotify a squad is a scrum team who sit together with all the skills required to design, develop, test and release to production. Different teams use different methods and each has a long term mission. Squads have access to an agile coach. There is no 'leader' but the product owner is responsible for prioritizing the work to be done by the team, not involved in how

they work. Most genuinely self managing groups would prioritize their own work to meet their goals.

All product owners collaborate to maintain a high level roadmap of where Spotify is heading (Kniberg and Ivarsson 2012). Despite using new names for the same old structures and functions, product owners are obviously just a higher level of management doing the coordinating and middle level planning necessary for coherent organizational function, a classic example of a DP1 organizational structure.

The literature includes several case studies most of which appear to be of agile being introduced into a DP1 structure without any awareness that the old and the new were based on irreconcilable design principles. As the whole notion of agile was based on only a vague notion of DP2 with an emphasis on autonomous teams, problems were only to be expected.

Generally, evaluations of agile are mixed. A quantitative analysis of 1002 projects across multiple industries and countries found that agile methods have a positive impact on both measurements of success used and that the quality of the mission or goals of an organization is a marginally significant moderator of this effect (Serrador and Pinto 2015). Fuchs (2019, p7027) believes "agile methods represent a vehicle to foster desired organizational change".

A survey of selected literature found that agile methods can effectively handle the special requirements for development and testing in scientific software but the evidence was stronger for small projects with relatively few members (Sletholt et al, 2011). Cagle (2019) makes the same observation as he saw that small teams could work as a group. However, he also claims that agile had it wrong from the very beginning as it was not that small teams worked better "because they could follow a lean and mean methodology to accomplish a project. Rather, small teams on small projects made it possible to follow a lean and mean methodology and have any luck at success". Larger projects and teams inevitable run into problems as he documents with conflicting demands of teams and managers amongst other things. He has watched agile descend into a religion which can now be used when waterfall would be more appropriate. Also, the increasing prevalence of Enterprise Data Systems means agile has become less relevant.

The critical challenges or problems arising in agile are resistance to it from the company's culture as well as teams, lack of management support, inconsistent processes and practices with poor communication and collaboration. Added to these were fragmented tooling and measurement together with lack of training and education (Kanbanize 2019). In their search for the 'sweet spot' between organizational control and team autonomy, Moe et al (2021) similarly found that intergroup coordination is a problem when teams attempt to work together on common goals. Both the cases they studied demanded more coordination and management. Yet in neither case did teams have sufficient authority or autonomy to qualify as self managing, self designing or self directing. *Neither independence nor interdependence was served.* Moe et al concluded there may not be a sweet spot as of course there cannot be with conflicting design principles.

Perhaps the most common problem noted was coordination or alignment. Using a sociotechnical lens to evaluate several examples of agile, Fuchs and Hess found that in the area of organizational structures, coordination and overall management, there was problematic coordination with other teams and other business units, inappropriate organizational structures and lack of top management engagement. In the culture related category, they identified major problems as inappropriate leadership dynamics and incompatible social structure although how these differ from organizational structures is not

discussed[1]. Altogether they identify 14 problems in 6 areas which is probably the most comprehensive list of difficulties in the literature. After their analyses of the two case studies, they listed even more problems and barriers. Overall, there is no clear idea, let alone definition, of what agile or its methods actually are (Fuchs and Hess 2018).

Miller (2013) summed it all up by saying "There is no definite proof that the return on investment from agile projects is higher than from traditional projects". It would seem that the rush into agile owes more to faddish opinions than empirical evidence.

Agile is the perfect example of a noble ideal coming to grief on total ignorance of how to attain that ideal. With the jumble of inconsistent, often contradictory and problematic fragments revealed by the literature, it is easy to see why some who work in the industry are concerned.

Methodology

As one in the series of studies exploring active adaptation in organizations, this particular study uses the same comprehensive conceptual design and core questions as described in deGuerre et al 2008. The exception is that we have removed the personality test from the survey as every single previous evaluation has shown that individual personality has insignificant power to influence the results compared to the very significant variables of design principles and enabling variables. All humans suffer in the same ways from DP1 and flourish under DP2, thereby denying theories that promote the primacy of particular behaviours and attitudes.

Each study is customized to meet the idiosyncracies of the organization or industry under the spotlight and this research into the software industry is no different.

As it turns out, that general question of what is going on in the software industry is a complex set of questions with a complex set of answers. In general, the data appeared very strange in some respects and as the analyses unfolded, it became obvious that this accurately reflected the nature of the software industry itself.

All good analyses begin with observation and this study demanded an extended period of observation and exploration of the innards of the dataset. It rapidly became obvious that whatever is going on in this industry, it was neither simple nor unitary.

It also became immediately obvious that for reasons of either language difficulties and/or lack of understanding of some industrial relations concepts such as 'hierarchy', some people may simply have misunderstood some questions. However, it may also reflect the 'philosophy' of new approaches such as Agile which completely ignore the reality of structures.

The questionnaire contains several check questions on supervision, relationships with and trust of peers, subordinates and superiors together with type of team the respondent mainly worked in plus position in the organizational hierarchy. Problems were encountered with this set of questions as several respondents showed a lack of consistency within the set.

[1] Fuchs and Hess discuss sociotechnical systems as two subsystems instead of two discrete systems and are apparently unaware that the sociotechnical definition they are using which includes hierarchies and authority structures is a non-jointly sociotechnical system which was the problem which the birth of jointly optimized sociotechnical systems with Trist and Bamforth (1951) solved. If they had been aware, they would have realized immediately that the lack of joint optimization would automatically cause multiple problems.

For position in the hierarchy, only 4 of those reporting that their workplace did not have a hierarchy showed the required consistency of other answers to qualify as working in genuinely self managing groups even if informal, that is, not governed by a legal agreement specifying the second design principle. The criteria adopted for this degree of consistency was no more than one inconsistent answer in the set of check questions. This small group, 3% of the total sample, have been taken out and studied separately.

Where the records on hierarchy and the rest of the set showed more than one inconsistent answer, the scores were recoded to the mean. It appears that people acknowledged their relationships with people above or below them but denied they had superiors or subordinates. It cannot be known for sure why there was this degree of inconsistency but is probably a combination of English as a second language, lack of understanding of the way hierarchy works and/or the language of popular approaches such as Agile. In its founding documents, Agile completely ignores any industrial realities. For example, one of the principles of Agile is "Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done" (Agile 2001). In other words, leave the current structure in place but without mentioning it. In particular, it ignores all the well known problems of diminishing motivation, trust and other effects with the most common form of structure based on the first design principle (Emery and Emery 1974; deGuerre et al 2008).

Agile emphasizes autonomous teams but specifies nothing about supervision or the location of responsibility for coordination and control. The Manifesto also emphasizes individuals rather than people working together so it seems it has created the perfect environment for laissez-faire as above. But as the literature has shown, different organizations have adopted uneasy mixtures of DP1 and DP2 so in some cases, the result would be functionally laissez-faire (Emery and deGuerre 2007; deGuerre and Emery, 2008).

Unfortunately, this confusion claimed a major variable called TeamType which is one of the four variables constituting the formula for the design principles (see Appendix A). This meant the formula had to be attenuated which has caused a weakening of the power of the derived scales.

As the core of the instrument is now well honed, and once the data was clean, the well known established concepts such as the intrinsic motivators were checked by causal path testing and created. The remaining dataset was similarly subjected to causal path analysis to determine the composition of other relevant constructed variables. These constructed scales are listed in Appendix A. These constructed scales together with remaining original variables not included in constructed scales formed the Master Matrix that was used in further analyses.

After substantial testing, it was decided as a first step to proceed with a standard analysis of causal path analysis followed by various other statistical analyses as a backup to the causal path. As the sample was top heavy with managerial positions as discussed below, it was the opposite of a normal hierarchy. Therefore, the sample was split into those above and below the mean. This allows us to examine the differences between the higher and lower sections of the hierarchy and start to identify the unique characteristics of, and problems in, the software industry.

As the results of this analysis were far from expected, showing many complications, the study from then on followed the indications thrown up by each previous analysis.

Throughout, only very simple and transparent statistics have been used so readers have maximum chance of following and understanding the findings.

The sample

The sample consists of 135 respondents from various parts of, and functions within, the software industry. Only one record has to be deleted in full because so much of it proved unworkable probably because of difficulties with the English language. Despite the best efforts of the organizer of the study, the sample was heavy on the higher parts of organizational hierarchy (64.4% about the middle to the top) and correspondingly light on the lower echelons (32.6% at or towards the bottom). The missing 3% are the 4 people who apparently worked in an organization with no hierarchy.

This meant the sample could not be analyzed as a whole because we have learnt from previous studies with this instrument that these different strata of the hierarchy have very different experiences in, and perceptions of, their organization and its effects.

As we see in Table 2, both the sample and the industry in the USA is predominantly male (Zippia 2022a and b). The sample is also older relative to the industry as would be expected from their positions but comparable in educational qualifications. In terms of occupational status, 82.2% of the sample claim 'professional, technical and related' status which is the highest category. As we would expect from these demographics, 83% of the sample have incomes of €70,000 ε or above with 42.2% earning more than €100,000. It is, therefore, very much a particularly privileged sample. While incomes vary by country and also city, the software industry also seems fairly privileged.

Our sample also has spent longer in their organizations than is found in the industry in the USA. Overall, it is older and of higher rank that is the industry which is another reason why the sample should not be analyzed as a whole.

Table 2. Comparison of sample and industry in USA

	Sample %	*Industry %*
Male	75.6	79.3 (78.0*)
Age 40+ years	68.7	46.0 (46.0)
Bachelor degree +	89.7	93.0 (95.0)
Less than 1 year in organization	26.7	30.0
1-2 years in organization	19.3	40.0
3+ years in organization	54.1	31.0

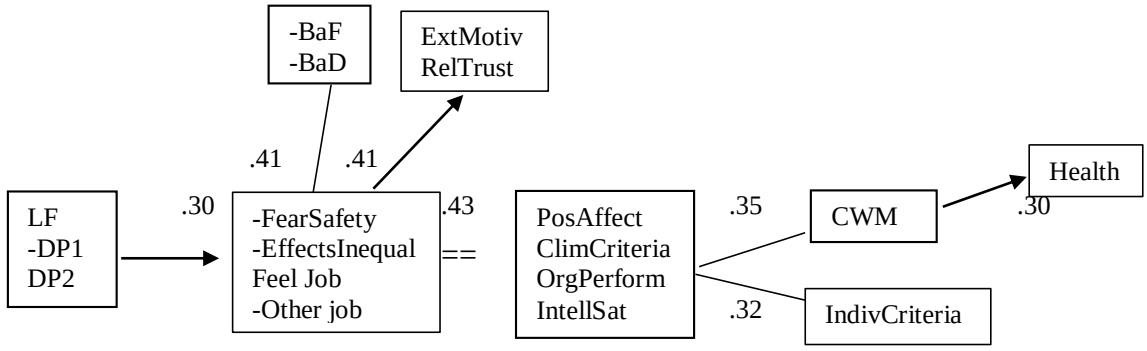
*The first set of figures are for software developers, the second for software engineers.

Conventional analysis

The results fell into four parts beginning with a conventional analysis. The variable called 'position' is used as a measure of position in the hierarchy of most conventional organizations and to determine how closely a sample conforms to the usual bureaucratic pyramid. When the ratios of what we roughly call managers to operators in the sample deviates from the normal ratio in real life as is the case here, the samples must be analyzed separately. Therefore, the sample was split above and below the mean.

Managerial sample

The causal path for the managerial sample is as follows:



N=87, r=.21 @p<.05, r=.27 @p<.01, r=.34 @p<.001

Figure 3. Causal Path for Managerial Sample (from M4)

Causal path graphs are read like road maps, start at the beginning and follow the arrows to the destination. An arrow denotes a causal relationship and a line a relationship without causality. The double line or equal sign denotes the core of the graph where variables have their highest relationship with each other. The theoretical basis for this form of causal path analysis can be found in Emery F 1976c.

The box on the left in Figure 3 contains the combination of the design principles Laissez-faire with negative DP1 and DP2. This combination leads to the combination of the low negative affects or emotions as they appeared in this study, fear for safety and the effects of inequality. They act together with a positive feeling about the job and not seriously looking for another job.

This part of the core is related to low levels of the basic assumptions of fight/flight and dependency and leads to external or extrinsic motivation and good relationships and trust with all levels of the organization except those below them in the hierarchy. This latter variable stood aside from the other measures of quality of relationships and trust and dropped out of this analysis.

The other side of the core consists of positive affect, combined with high scores on the second half of the 6 criteria or intrinsic motivators, those describing the climate of the workplace, a high rating for the organization's performance in terms of factors such as innovativeness, productivity, and quality, and a high degree of intellectual satisfaction (Appendix A).

The right side of the core is related to the creative working mode which determines high ratings for health, and related to the first half of the 6 criteria, the intrinsic motivators, those that pertain to the individual and ideally should be optimal for every person in the organization.

When we breakout the core of the diagram in Figure 3, we find the following (Figure 3a):

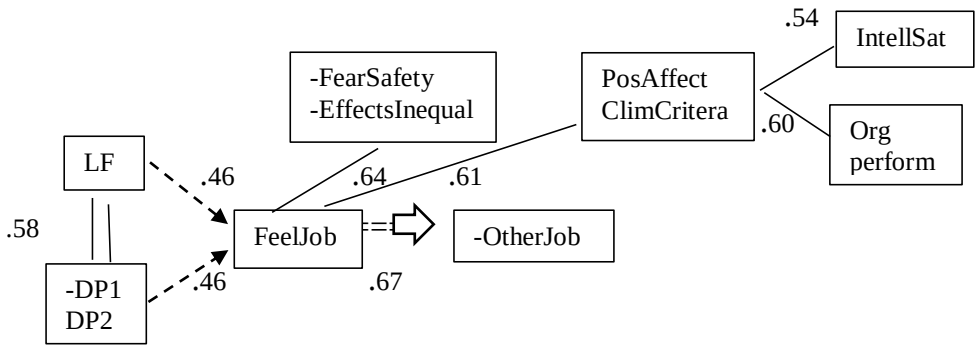


Figure 3a. Breakout of core from Figure 3

Figure 3a leaves no doubt that the only variables here that could be determining results are the design principles. There is a reciprocal relationship between laissez-faire and the combination of low DP1 and DP2 which both have a high secondary relationship with how people feel about the job. All the others are enablers, which sit between the determinants and the outcomes, with exception of not looking for another job which is clearly an outcome (Emery and Aughton 2006; deGeurre et al 2008).

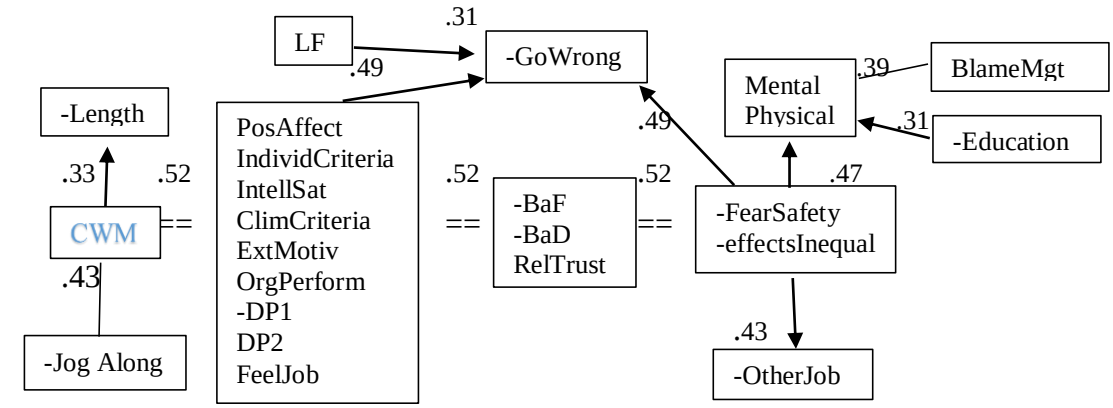
The observant reader will have noticed that there are no demographics in the above graphs. That is not particularly unusual as while a small range of demographics usually function as determinants or anchoring points for a causal path, the most powerful determinants are the structures. In this case, all the demographics dropped out at various stages of the analysis. Also dropped out were the measures of days off sick, length of time in the organization, the degree to which things went wrong in the organization and the propensity to blame managerial staff when things went wrong.

The absence of these variables from the final pictures confirms that the higher echelons in the software industry have a fairly rosy view of it.

Operational sample

Figure 4 presents a confused and confusing picture. Several of these clusters of variables simply should not be found together in the one graph such as blaming management for good health or the creative working mode leading to short stay in job. We normally see the creative working mode associated positive outcomes.

In the core of the graph, we see the same set of enabling variables clustered together in a similar fashion as appeared in the managerial sample. Overall, more variables survived the analysis, 24 as compared to 18, and we see lower education retained as one of the demographic determinants, again a surprising result as good health is usually associated with higher levels of socioeconomic status. We also see more outcomes including shorter length of stay and not looking for another job.



N=44, r=.29 @p<.05, r=.37 @p<.01, r=.46 @p<.001

Figure 4. Causal Path for Operational Sample (from M5)

This graph hardly distinguishes the managerial and operational samples which again is contrary to all previous studies using this instrument. These subsamples, which usually come from fairly coherent DP1 organizations, are often vastly different in their appreciations of their organization's performance and its effects on them.

The separation of LF from the two design principles in Figure 4 raises the suspicion that there are two separate forces contributing to this messy and improbable set of results. This possibility was examined resulting in Table 3 below.

Table 3. Distribution of design principles and laissez-faire in managerial and operational samples

	High LF*		*High DP1*		*High DP2*		*Total*	
	N	%	N	%	N	%	N	%
Managerial (87)	51	58.6	30	34.5	50	57.5	131	150.6
Operational (44)	20	45.5	22	50.0	15	34.1	57	129.6
Total (131)	73	55.7	52	39.7	69	52.7	194	148.1

*Where high means above the mean

The number that jumps out of table 3 is 73, 55.7% of the total, telling us that the sample is predominantly high laissez-faire (LF) followed by high DP2. This echoes the Agile Manifesto. The managerial sample is high on both laissez-faire (LF) and DP2 while the operational sample is high on LF and DP1. These figures add up to more than the sample sizes because some respondents fell into the high category of two of these variables.

No wonder the pictures in these two samples conventionally defined are so different from usual. The subsamples as well as total sample are a mixture of all three types with that slight predominance of LF. For the sake of completeness and to attempt to cut through the contamination caused by the mixing of the design principles, we tested all variables between the managerial and operational samples.

There were only 14 differences between the managerial and operational samples out of a long list (see Table B1 in Appendix B), confirming that many had been suppressed by the

mixture of the design principles as above. These differences were all in the direction we have come to expect from previous research. The operational sample had a lower score on control, a higher mean score on DP1 and a lower one on DP2 as we would expect from Table 3. The operators also had lower mean scores on all the critical variables that determine motivation, how they feel about their jobs which is really another measure of motivation, intellectual satisfaction, the creative working mode, trusting subordinates and of course income and SES. While they suffered poorer scores on all the first half of intrinsic motivators, the individually oriented criteria, only mutual support and respect in the second half which inhere in the climate of the organization, was lower for the operators although the second set taken together was also higher for the managers. The lack of mutual support and respect amongst operators fits with their lack of trust in subordinates.

Differences with self managing groups

Before we leave this section of the results we must return to the 4 respondents who appeared to work in self managing groups even if embedded in a legal DP1 structure. Two of them work in teams without a leader where they share work to meet team goals, one works in a team without a leader where they work as individuals specialists but have to coordinate to meet team goals and one sometimes works in a team without a leader but only for projects and/problem solving.

In terms of demographics, all are male, between 40 and 49 years old and have professional, technical and related occupational status. Three have a higher degree and one has a post school qualification. They all earn 80,000 euros or above. In other words, there is nothing remarkable about this group, except that their scores consistently show a profile which appears that of self managing groups in a DP2 structure. When you examine the differences summarized below, you can understand why this group all love their job.

Tables B2 and B3 in Appendix B present the full list of differences They makes it clear that the self managing group (smg) or informal DP2 sample is far superior to the operational sample with 19 differences and to the managerial sample with 16 differences.

These similarities and differences are easily summarized. The smg sample is superior to both managers and operators on control, DP2, supervision, occupational status, the three individual intrinsic motivators of mutual support and respect, social value and seeing the whole product or service, the second half of the intrinsic motivators concerning the social climate of the organization and the full set.

So while coordination did not show up as a difference between the smg sample and operators, its effects did. Variables such as mutual support and respect and seeing the whole product or service are highly dependent on coordination as people work together on common goals.

They are similarly superior to both managers and operators on intellectual satisfaction, dependency, and both measures of negative affect, fears for safety and the effects of inequality. Unsurprisingly they are superior on how they feel about their jobs and not looking for another one.

The smg sample is superior to both the managers and operators on control, supervision and DP2. It is lower than the managers on DP1 but not the operators. This is because agile has been differentially applied to managers and operators.

Even though the smg sample is closer to the managerial in its occupational status but not SES more generally, it outclasses that sample in its motivators and outcomes. The only one

that could be queried as fitting this pattern is number of sick days taken but this is not necessarily a measure of slacking off at work or having poorer physical or mental health. More likely it means that they work for organizations which recognize that it is better for employees to stay home when they are sick rather than treating them as cogs in the machine, replaceable parts, by not providing adequate sick leave.

We also see that the smg sample did not differ on the first half of the 6 criteria except that it was superior to the operational sample in terms of the one component of variety of work. From this we deduce that the people in the operational levels are often stuck in boring routine jobs which are shared around in a self managing group.

While the smg sample had higher control and lower supervision than the operators, they did not differ in their level of coordination. This tells us that while the smg sample enjoys a much higher quality of working life, it almost certainly does not represent a legal DP2 structure as we would expect a high degree of coordination in that case. Even in workplaces with very high levels of specialization, the specialists coordinate their work to achieve group goals. This is not the case in this data.

The smg sample consistently provided a higher quality of both personal and organizational benefits. Some of the difference here are dramatic, particularly those for the effects of inequality. We know from our previous organizations that these affects are powerful influences on motivation as they are here and on all these measures of motivation including how people feel about their job, the smg sample is superior.

It follows from this large number of differences that most of sample are not working in self managing groups or a DP2 structure at all, no matter what the enthusiasts may claim. The differences are just too great. In other words, what this analysis shows is that the 'do your own thing' approach is a long way from the genuine article. It represents that same confusion between democracy and laissez-faire that Ralph White exhibited in the social climates experiments (Lippitt, 1940) and seems endemic in North America.

Imagine the levels of motivation and productivity the software industry would enjoy if the entire workforce looked more like this little smg sample!

Following the leads in this part of the analysis we proceed to examine what the causal paths look like for the LF, DP1 and DP2 samples. As there are differences appearing in the components of the design principles and the 6 criteria, these variables will be entered into the matrix individually rather than as a set.

Analysis by design principle

The sample was split into Laissez-faire (LF) DP1 and DP2 above and below the mean. A full correlation matrix was calculated for each of the high LF, DP1 and DP samples and the highest correlation for each variable in the zero order matrix identified. It was then divided into clusters around supervision, control and coordination, the three main contributors to the scales for the design principles. The size of each cluster was then calculated from the percentages above the mean for each constituent variable (unless the variable had been reversed in which case it was percentages below the mean) and then averaged. The resulting sample sizes are shown in Table 12. This gives us a much more detailed picture of what is going on in this industry with much greater explanatory power.

The high LF sample.

The largest cluster in the high LF sample is built around control with a 35.1% share. The cluster consists of the variables in Table 4:

Table 4. Control cluster for high LF sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Control	75.5	-Look for other job	47.9	Mental health	41.1
Positive affect	58.9	-Fear for safety	61.6	Physical health	37.0
CWM	35.6	-Effects of inequality	57.5	-Sick days	71.2
Intellectual Satis	57.5	Education	50.7	Income	61.6
Feel +ve about job	65.8	Age	69.9	-Gender	78.1

As Table 4 shows those enjoying high control in the high LF sample are generally a fairly happy and satisfied lot who are male, older and of higher SES. However, there some signs in this cluster that although a majority have high positive affect and nearly 66% feel positive about their job, they only like rather than love them (45% to 22.1%). More than half are looking for another. Things could definitely be better. The percentage enjoying the creative working mode could be much higher and far more should be getting high levels of intellectual satisfaction. More could also be enjoying better physical and mental health, particularly for their socioeconomic position but they are not taking a lot of days off. Good health is usually highly correlated with high SES so it looks as if LF is a health hazard. Having high control is not enough.

Table 5. Coordination cluster for high LF sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Coordination	69.9	Relate & trust	49.3	Blame whole team	57.5
Intrinsic motivation	58.9	Org performance	41.1	Blame individuals	47.9
External motivation	47.9	Position	31.5	Blame supervisors	45.2
Trust down	46.6	Length stay	57.5	Blame management	50.7

In the coordination cluster (Table 5) we see above average levels of intrinsic motivation where most people have occupied their jobs for longer than average. As we would expect from reasonably coordinated organizations, they blame the whole relevant group when things go wrong although some tend to blame management. However, percentages for external motivators, organizational performance and the good indicators of a healthy workplace such as trusting subordinates and enjoying positive relationships and trust generally are too low.

This is the smallest of the three clusters in high LF demonstrating that coordination is the weak spot in LF.

Table 6. Supervision cluster for high LF sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Supervision	56.2	Blame nobody	63.0	Dependency (baD)	53.4
Things go wrong	61.6	Fight/flight (baF)	53.4	Jog along (baP)	39.7

Table 6 presents the results for the supervision cluster in high LF. There are only 6 variables in this cluster and they paint an exact and quite devastating picture of how high supervision affects the behaviour of employees. This is the cluster that features things going wrong where nobody gets blamed and they experience high levels of the group assumptions of fight/flight and dependency together with fewer attempts at the basic assumption of 'pairing' in its regenerative form, that is attempting to pull the group back together for constructive work.

While there is relatively high supervision, the presence of nobody getting blamed when things go wrong, is one of the key indicators of LF. Working here would be a horrible experience and this cluster shows how *not* to design an organizational structure.

Overall, the slight preponderance of control over coordination and the dramatically negative portrait of the mixture of high supervision without correcting mistakes, demonstrates the weaknesses in the majority response of laissez-faire in the software industry. There is no coherent pattern as different organizations have interpreted whatever organizational theories they have adopted. No organization can function optimally let alone well without strong coordination and this is the really weak link in the majority pattern. These patterns foreshadow the realization that the software industry is a patchwork of ill-fitting and incongruous juxtapositions of crucial structural variables.

The high DP1 sample

Again control is the cluster with the highest percentage of the sample (35.4%) and here they are higher in the hierarchy and well motivated. However, again we see that all is not well as levels of the creative working mode, trusting subordinates and organizational performance are too low (Table 7).

Table 7. Control cluster for high DP1 sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Control	50.0	Org performance	42.3	Blame whole team	44.2
Intrinsic motivation	61.5	Blame individuals	44.2	-Education	42.3
Social climate mot	57.7	Blame management	44.2	Position	57.7
CWM	44.2	Blame supervisors	61.5		
Trust subordinates	36.5	-Blame nobody	36.5		

When things go wrong, they are likely to lash out and blame anybody particularly supervisors but the majority do ascribe blame and do not allow mistakes to go unnoticed.

The coordination cluster in the high DP1 sample is also not a particularly happy group (Table 8). Bare majorities scored well on relationships, trust, dependency and external motivation but only a third either like or love their job and over 50% are looking for another one. The figures for health could be a lot better.

Table 8. Coordination cluster for high DP1 sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Coordination	55.8	External motivation	50.0	-Sick days	46.2
Positive affect	44.2	Feel about job	32.7	-Occ status	21.2
Intellectual satis	48.1	-Other job	51.9	-Length of stay	48.1
Relate & trust	53.8	Physical health	26.9		
-Dependency (baD)	59.6	Mental health	59.6		

We would expect relatively better figures for a coordinated sample even within a high DP1 sample but it seems the deadening effects of the first design principle have over ridden whatever advantages some coordination could bring.

Table 9. Supervision cluster for high DP1 sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Supervision	44.2	Effects of inequality	42.3	Age	26.9
Things go wrong	17.3	Fight/flight (baF)	50.0	-Income	48.1
Fear for safety	46.2	Jog along (baP)	50.0		

Only 44.3% of the supervision cluster (Table 9) have above the mean levels of supervision meaning that most are not supervised closely. People in this cluster are younger with lower incomes and most do not seriously experience negative affect at work although levels of fight/flight and having to jog work along are slightly higher.

We would expect supervision to be high in a high DP1 sample so Table 9 illustrates just how profoundly the laissez-faire approach has infected this industry.

The high DP2 sample

Table 10. Control cluster for high DP2 sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Control	71.0	-Sex	79.9	Income	56.5
Age	71.0				

Control is again the largest cluster in the high DP2 sample but includes only three variables other than control. These demographics reflect the industry at large being predominantly males, older and with high incomes (Table 10).

Table 11. Coordination cluster for high DP2 sample					
Variable	*Above mean%*	*Variable*	*Above mean%*	*Variable*	*Above mean%*
Coordination	39.1	External motivation	47.8	Blame individuals	79.7
Intellectual satis	59.4	Org performance	53.6	Blame management	90.9
Feel about job	30.4	CWM	39.1	Blame supervisors	91.3
Trust subordinates	49.3	Physical health	42.0	Blame whole team	95.7
Individual Criteria	66.7	Mental health	47.8	-Blame nobody	15.9
Climate criteria	46.4	-Sick days	38.3	-Fear for safety	52.2
Positive affect	55.1	-Go wrong	0.0	-Effects of inequality	58.0
-Other job	66.7	-Fight/flight (baF)	30.1	Education	55.1
Relate & trust	47.8	-Dependency (baD)	55.1	-Occupational status	15.9
Trust subordinates	49.3	Jog along (baP)	5.8	Position	34.8

Coordination is the smallest of the three clusters in the high DP2 sample (Table 11)which tells us immediately that although this was the sample which had scores above the mean on the scale for DP2, it is a long way from being real or legal DP2. In the latter, coordination would be the most obvious basic feature.

Although many of the positive indications of good function are found in this cluster, it is far from a high positive picture as many of those key indicators such as the criteria for social climate are too low, confirming that coordination has been neglected. When people are working together and coordinating their work, they create high levels of factors such as mutual support and respect which is one of the criteria for social climate. Similarly, the figure for the creative working mode is too low as it again depends on people creating and celebrating together. The somewhat low figures for health are only to be expected when we see low percentages such as the above and a reasonable figure for positive affect cannot compensate for so many below the mean such as relationships and trust.

There is no clear cut picture of how blame is assigned when things go wrong although the percentage for the whole team is slightly the highest and few blame nobody. These figures show that some people have some rudimentary idea of how a well functioning organization should behave.

However, again it is quite clear how pervasive the individualistic and laissez-faire approach has been in this industry.

There is no cluster for supervision in the high DP2 sample. Supervision could not be separated from the coordination cluster and attracted no variables to itself. Supervision accounted for 30.5 of the total (Table 12), just slightly higher than the coordination cluster.

This result confirms again that whoever created these structures had no idea of the second design principle and were working from models which set people against each other

producing poor results for both people and organization. These models could not be recommended to anyone.

Table 12 shows that in the three very different samples, control commanded by far the largest share of the clusters. It was highest for the DP2 sample where it should have been roughly equal in size to coordination. Obviously individual control was the primary concern with little realization that organizations simply cannot function effectively without hefty quantities of coordination. There also appears to be little recognition that without people genuinely working together on shared goals, they cannot obtain adequate levels of several intrinsic motivators.

Table 12. Distribution of supervision, coordination and control in three conditions

	Supervision	*Coordination*	*Control*	*Total*
High LF (73)	33.7	31.1	35.1	99.9
High DP1 (52)	30.1	34.0	35.4	99.5
High DP2 (69)	30.5	28.7	40.7	99.9

Supervision claimed the lowest share of the samples in 2/3 cases demonstrating once again that supervision has perhaps been perceived as an obstacle to good practice so the solution was to abolish it. However, some managers would have been well aware that in the absence of any coordination, some supervision was required. The data indicate that these managers are in a minority as only 41.5% of the total sample score above the mean on supervision, being supervised a little closely or more so. We will return to this figure.

Overall this analysis shows that this industry is in a state of total confusion, a collection of best guesses.

Table 13 gives a clear overall picture of the state of the industry in terms of supervision, control and coordination.

Table 13. Low and high supervision by control and coordination

	Low supervision		*High supervision*		*Total*	
	N (% of whole)	%	N (% of whole)	%	N (% of whole)	% of total
Low control & coordination	2 (1.5)	2.5	9 (6.7)	16.1	11 (8.1)	8.1
High control & coordination	48 (35.6)	60.9	24 (17.8)	42.9	72 (53.3)	53.3
Low control & high coordination	6 (4.4)	7.6	12 (8.9)	21.4	18 (13.3)	13.3
High control & low coordination	23 (17.0)	29.1	11 (8.1)	19.6	34 (25.2)	25.2
Total	79 (58.5)	100.1	56 (41.5)	100.0	135 (100)	99.9

There are a few cases in every cell of Table 13, no matter how improbable. However, the table does show just how resilient and resourceful people are when trying to make their organizational structures work. Whether supervision is low or high they tend to take control as intended and in fewer cases, work together to coordinate across individual jobs. And as we have seen throughout the study, the majority of responses show low supervision (58.5%).

The highest proportion of cases are for the high/high combination and the second highest combination is high control and low coordination. Low supervision is the main contributor to high control in both cases. Again we see the emphasis on control over coordination where 78.5% is high control while only 21.4% is high coordination.

Low supervision yielding the high/high combination is what we would expect from a DP2 structure but all the previous results confirm that this is only a poor reflection of that. It shows, however, what the various methods or theories used in the industry are trying achieve without actually changing the design principle, or even putting one into action.

Low supervision yielding the two high/low combinations appear as other variations on attempts at DP2 but again without the requisite understanding of the design principles. They are examples of modified LF. Low supervision yielding the low/low combination represents the slackest of all options, the pure LF option as in no structural relationships at all. One begins to wonder how the organization functions at all. Fortunately, there were only 2 or 1.5% of them.

High supervision is the main contributor to the low/low combination as we would expect and is an accurate reflection of DP1. But there are only 9 or 6.7% of them in the total meaning the industry as a whole has successfully tried to escape DP1 but in the process has gotten lost in the wilderness.

High supervision giving us the high/high combination could be a ghastly place to work as everyone would be in total confusion or conflict about who was responsible for what. The supervisors would be tearing their hair out but everybody is ignoring them. There are 17.8% of them. As we saw above, some respondents do experience high levels of fight/flight (baF).

High supervision is also the major contributor to the low control, high coordination combination which is highly unusual. These few cases could be the result of the operations staff taking a previous or failed DP1 structure into their own hands to try to rescue their organization by getting together. When it results in high control, low coordination we would again expect high levels of both main negative dynamics of fight/flight and dependency, confirming results above.

Table 13 demonstrates why simple straight forward measures of the design principles and laissez-faire do not work very well in this industry. There is literally every possible combination of the three main components of supervision, control and coordination.

However, the 58.5% for low supervision is slightly misleading as more than half (23.7%) of the 41.4% who fell above the mean reported they were supervised only 'a little closely'. In most organizations this would be on the very low side.

If we had deviated from the above or below the mean rule and included 'a little closely' in the low supervision sample, we would have had 82.2% low supervision and 17.8% high. This really brings home the fact that the vast majority of the industry has adopted the belief in 'structure bad, no structure good' quite unquestioningly. The cells with low supervision in Table 13 would then have been more highly populated. It appears to be the lack of knowledge of organizational structure and function more generally that has caused this current mess.

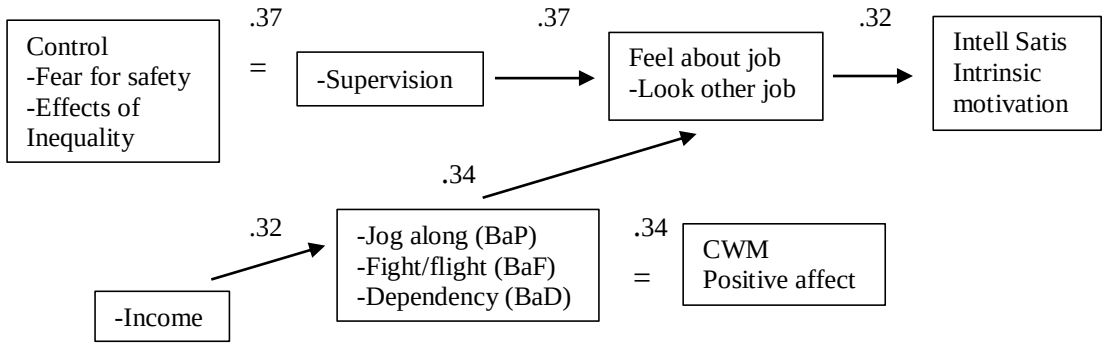
Analysis by outcome

To complete this portrait of the software industry we take a glimpse into a range of the most critical outcomes for people and organizations alike. A sample of the extremes for each variable will show its determinants and main features. To keep it to the most powerful

variables, those appearing in the matrices were those with correlations at the p<.01 level rather than p<.05 apart from supervision, control, and coordination.

The highly motivated

The causal path for high intrinsic motivation is presented in Figure 5. It shows that high control and low supervision plus a smaller contribution from lower income eventually leads to high intrinsic motivation. Coordination's contribution to positive feeling about job fell just below significance.



N=42. r=.30 @p<.05, r=.39 @p<.01, r=.49 @p<.001

Figure 5. Causal path for high intrinsic motivation (from M3)

Control clustered up with low levels of the negative affects in this study, fear for safety and effects of inequality, and in a reciprocal relation with low supervision leads to people feeling positive about their jobs and consequently, not looking for another one. This leads to intrinsic motivation grouped up with intellectual satisfaction.

The other determinants are lower income, low levels of all the negative basic assumptions and its reciprocal relationship with higher levels of the creative working mode and positive affect. This is the same pattern which has emerged throughout the research, namely a picture of laissez-faire (LF). The absence of coordination confirms that is LF rather than DP2. Given that this is probably the best people in the industry see around them, and which in some cases at least, has been recommended to them, it makes them sufficiently satisfied to get reasonable levels of intrinsic motivation.

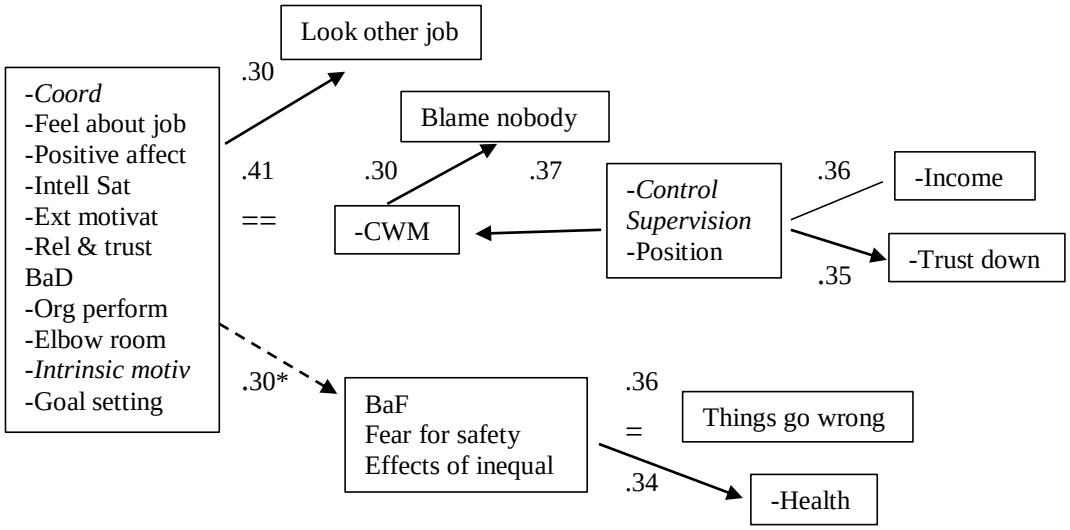
The poorly motivated

Figure 6 presents the causal path for low intrinsic motivation.

This causal path paints a portrait of a very bad job. It is an uneasy mixture of DP1 and laissez-faire with high supervision, low coordination and control combined with blaming nobody when things go wrong which they frequently do.

This portrait pertains to the lower echelons of their organizations where we see all the hall marks of poor quality work including all of the basic assumptions behaviours and low intellectual satisfaction along with the negative affects of fear for safety and the effects of

inequality. Naturally enough, the outcomes are low motivation both intrinsic and external, low trust, poor health and looking for another job.



*This correlation has been corrected for attenuation from iteration. Other correlations have not.

N=42. r=.30 @p<.05, r=.39 @p<.01, r=.49 @p<.001

Figure 6. Causal path for low intrinsic motivation (from M6)

It is important to remember that this is a picture of about one third of the total sample and there is nothing in the data to suggest the picture would improve dramatically if the sample sized was raised by a few more percent. We can take it from this that a significant proportion of those working in the software industry have very poor working arrangements.

Because so many of the critical factors clustered into the big box on the left of Figure 6, the core of this path has been taken out separately as Figure 6a.

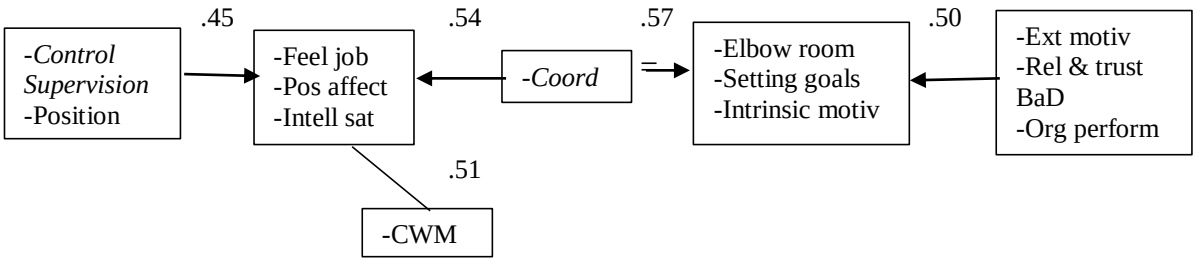


Figure 6a. Breakout of core from causal path for low intrinsic motivation

In Figure 6a we see that both a combination of high supervision, low control and low coordination (DP1) is a powerful determinant of low positive affect, low intellectual satisfaction and how people feel about their jobs, which is tied to low levels of the creative working mode.

We also see that low coordination makes a separate contribution to the cluster of low elbow room and low chance of a person setting goals for their own work which are two of the individual criteria for intrinsic motivation, plus the total score for intrinsic motivation. Thus we see that *low coordination makes a more powerful contribution to low motivation than control*. The box on the right of low external motivation, low quality of relations and trust, high levels of dependency and low organizational performance also makes a contribution to intrinsic motivation.

In contrast to the causal path for high intrinsic motivation where we saw that low supervision and high control was sufficient to produce high intrinsic motivation, it is the lack of coordination which is the most powerful determinant of low intrinsic motivation. This is something practitioners have been aware of for a long time. It is well known in some circles that intrinsic and external motivation have an asymmetrical relationship as external motivation such as higher pay cannot produce intrinsic motivation in the long term but poor or unfair and inequitable pay can certainly reduce it.

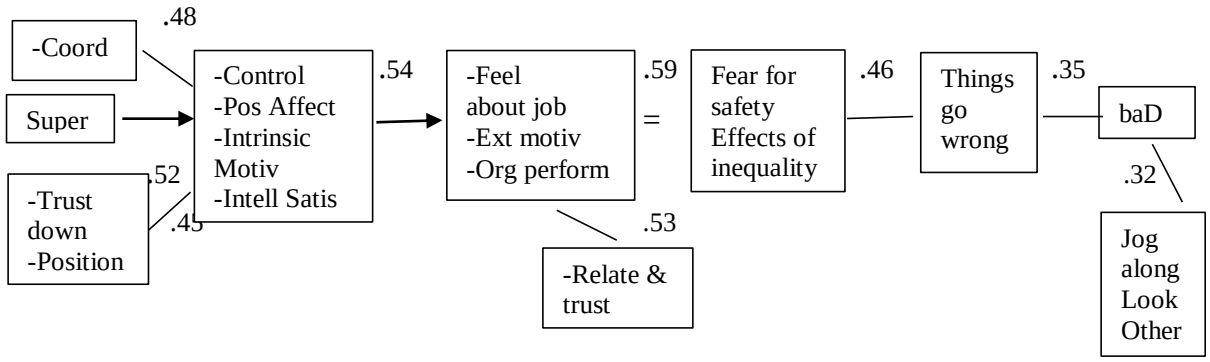
As many of the theories being put into practice in the software industry at the moment are basically laissez-faire as shown above, they are incapable of yielding reasonable levels of coordination and therefore, always run the risk of producing unhappy and unmotivated personnel, particularly at the lower levels of the hierarchy, which of course some of these approaches pretend doesn't exist. This study shows that it does.

Dependency

One thing no organization should want is high levels of dependency (baD). The basic assumption behind this behaviour is that there exists a great and powerful being who exists to ensure that no untoward events will follow the irresponsibility of individuals, to provide security for them (Bion 1952, 1961). They do not have to learn, and in this mode, there is less learning than in any other mode. The questions used to measure dependency involve reluctance to participate, waiting to be told, ignoring bright ideas and giving up easily (Appendix A).

It is easy to see that the assumption of dependency can arise when the structure is DP1, particularly so when it is strictly enforced. This is indeed the case (Emery M 1999) and we see it again in Figure 7.

Figure 7 paints a dismal picture of the determinants of dependency as it includes low levels of the most critical variables of intrinsic motivation, positive affect and intellectual satisfaction among others. Needless to say it would be a very unhappy workplace where people fear for their safety and experience the effects of inequality, where things go wrong and there are low quality relationships and little trust



N=33. r=.32 @p<.05, r=.42 @p<.01, r=.52 @p<.001

Figure 7. Causal path for dependency (from M3)

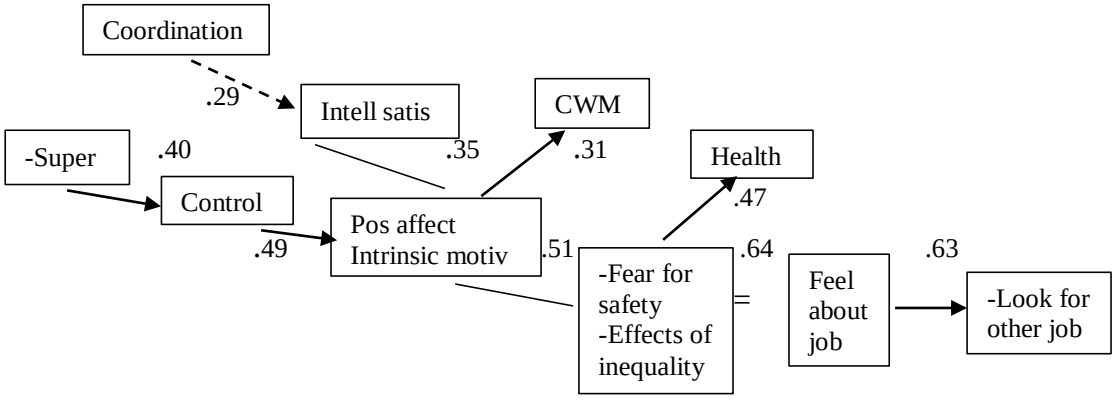
Together with dependency we find its partner, having to jog things along when productive activity stalls, as it would frequently do when people are gripped by dependency. People trying to retrieve the situation in such a way is an example of the basic assumption of 'pairing' (baP) in its regenerative form (Emery M 1999 127-132). It shows that no matter how bad the situation may feel, some people will always be hopeful that it can be righted. However, because it is such a demotivating and negative workplace, people are also looking for other jobs.

It is primarily a picture of how people on the lower ranks of the hierarchy experience their organizations and as we see from the conjunction of high supervision, low coordination and control, it is by definition a DP1 structure. This covers just over 16% of those sampled.

The creative working mode

In contrast to dependency, what every organization needs to fuel its innovation and achieve psychological satisfaction for its employees, is the creative working mode (Figure 8). The creative working mode has now been observed many thousands of times and has been renamed from Bion's "W', for work, to better reflect its nature. It does not look like what many people think of as 'work': you see people in animated discussion, excited yet controlled, sparking ideas off each other in a sometimes playful manner with people cracking jokes, but this is how serious innovations spring into life. This is spelt out in Emery (1999).

As may now be expected, the structural determinants of the creative working mode consist of low supervision, high control and coordination which just missed reaching significance. If it had reached significance, this would be a DP2 structure which made up 35.6% of the sample. It falls somewhere between that and the 17% which have low supervision, high control and low coordination. So despite the fashionable theories which we can see have had a damaging impact on the software industry, roughly a quarter of the sample managed to avoid serious levels of laissez-faire and find their way into a structure producing a reasonable healthy, productive and creative workplace.



N=42. r=.30 @p<.05, r=.39 @p<.01, r=.49 @p<.001

Figure 8. Causal path for creative working mode(from M1)

The structural conditions acts through intellectual satisfaction, positive affect and the intrinsic motivators to produce the creative working mode. Close to the intrinsic motivators are low levels of the negative affects which lead in turn to good health. All of these factors accumulate to make people love their jobs and not think of looking for another.

We note here as found in the other outcomes that demographics played no role in producing these outcomes: they are purely the result of the structure.

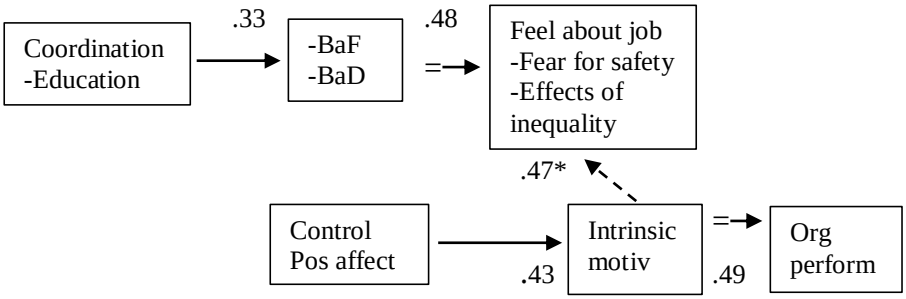
High organizational performance

Organizational performance is that constructed variable which consists of the major factors usually considered to be necessary for organizational success, and which clustered closely together in this study. These factors include being innovative and highly productive with good quality (see Appendix A).

Because the reader will now be aware of how variables cluster up in this database, only those variables that presented correlations at the p<001 level were entered into the matrix except for control, coordination and supervision. This ensures the resulting causal graph will contain only the most powerful determinants of good organizational performance.

Figure 9 shows that for an organizational to be perceived as a high performer, it must provide high levels of the intrinsic motivators. Without people putting their hearts into their work, factors such as highly qualified management means little. Coordination combined with lower educational levels makes a contribution leading to various enablers such as low levels of the main negative basic dynamics which then lead people not to suffer from fear for their safety and not to experience the effects of inequality and so feel positively about their job.

Control makes a more direct contribution to the intrinsic motivators and then to organizational performance. Supervision dropped out but the pattern is essentially that of a DP2 structure in action where the employees enjoy high levels of both coordination and control.. In other words, if an organization wants to improve its performance, it should change to a DP2 structure.



*This correlation has been corrected for attenuation from iteration. Others have not.

N=33 r=.32 @p<.05, r=.42 @p<.01, r=.52 @p<.001

Figure 9. Causal path for high organizational performance (from M2)

It should by now be easy to contemplate what a low performing organization would look like and the simplest way of obtaining a picture of that is to reverse the signs of all the variables in Figure 9. As supervision dropped out, it would be a totally laissez-faire organization where people in doing their own thing to gain their own individual control get in everybody else's road and in so doing robbed everyone of even that modicum of positivity. It would be wracked by negative dynamics and affects leaving totally dispirited and unmotivated people. This covers just over 16% of those sampled (Table 13).

Differences between software industry and others

In this section we examine any differences between the software industry as represented here and the other organizations on our cumulative database. There are eight organizations included in this dataset and not all used exactly the same questions or scales. Only those cases where there is total comparability are included in this study of differences.

The other eight organizations are a diverse group covering both blue and white collar work, some extremely dangerous manufacturing and many different types of work including various specialists in a national caring or welfare organization.

It is fair to say that all of them were designed and basically functioned as DP1 structures. It is also fair to say that they all were failing in various ways which was the reason for the contact.

Differences in structural conditions and demographics

As we would now expect from the results above and the fact that the other organizations were DP1, the software sample experienced significantly lower supervision with higher control and coordination (Table B4).

The other variables included in the definitions of the two design principles and laissez-faire were the locations of blame when things went wrong. Table B4 shows that the software industry less frequently laid the blame with all the locations except nobody. This is the

location included in the definition of laissez-faire and reinforces all the analyses above that the sample is mainly laissez-faire.

Just to sum up these location variables we included the variable accountability in this set and find it is significantly lower than in the other organizations. This is of course only to be expected from laissez-faire organizations where there is no clear location of responsibility so there is no clear location of, or sense of, accountability.

Accountability is one powerful factor in determining individual's feelings about their organization as people have an innate sense of fairness and justice about attributing blame. Hence it affects their motivation towards working there. It is also an important factor in assessing the worth of the various agile approaches to structural design that have been applied in the software industry, and certainly on these figures agile would have to be judged a failure.

Table B5 shows that the other organizations on our database are more mixed and diverse demographically than this sample of the software industry which we know already is an older, more socioeconomically privileged segment of the population at large. There were no differences on gender. From previous research we know that the higher in the hierarchy people are, the more positive their views of their organizations tend to be for the very real reason that management usually organize much better working conditions for themselves than they organize for their operations staff. This proved the be the case in the software industry as well as we saw in Table B1.

They have, however, spent fewer years in their current organizations which probably reflects greater turnover in the software industry as we know more people are actively looking for another job compared with the other organizations. This is because they are less satisfied with their current jobs than even those working in the failing DP1 structures.

Differences in enabling conditions

Enabling conditions are those conditions closely related to the structural variables that lead to outcomes, those that show up in the intermediate stretches of a causal pattern between the structural and demographic variables and the outcomes. We begin with those differences that constitute the *cognitive or intellectual dimension* of the workplace (Table B6).

The software industry is falling behind in adequacy of its training and shows more knowledge held by staff than is currently being used. These are failures of the basic management functions. There were no differences in amount of learning on the job. However, it shows a higher level of mental demand in the jobs and people experience a higher sense of achievement. This is no doubt due to the higher level of individual control and while this is an advantage for the individuals involved, seems to do little for their overall appreciations of their work.

The software industry enjoyed higher levels of the four measures of extrinsic motivation (Table B6) and this study reconfirms that this factor does not make a significant contribution of satisfaction with the work. There was no difference on workload.

The software industry showed higher score on *trust* between peers and subordinates and more cooperate *relationships* throughout. They did not differ on trusting superiors or relationships with them.

Again the software industry proved more successful in its *group dynamics,* experiencing lower levels of fight/flight, higher levels of the creative working mode and having to jog

things along which is a measure of the basic assumption of pairing in its regenerative form. There were no differences in the basic assumption of dependency.

In terms of *affects*, the software industry achieved higher levels of the individual positive affects of feeling excited and creative and lower levels of feeling powerless and humiliated. Overall, there was no difference on the positive affects or fearing for their safety but the software industry experienced fewer effects of inequality than the other organizations. So it seems these structural variants have managed on average to ameliorate the effects of DP1 on people but this is not a particularly successful result when we consider these others were organizations calling out for help.

Results for the *intrinsic motivators* are mixed. The software industry achieved higher scores on the individual criteria of variety, adequate elbow room or autonomy and being able to set goals for themselves, as we would expect from their higher levels of control. They also achieved a higher score for mutual support and respect but lower for social value of the work. Overall, the software industry could not achieve higher scores for the intrinsic motivators as a set than the other failing organizations.

Differences in outcomes

On measures of *organizational performance*, there was no difference on innovativeness while the software industry rate their quality of work higher but their productivity lower (Table B7). They could not do better than the others on the frequency of things going wrong and despite this being closely associated with supervision and DP1.

In terms of *personal health*, the software industry achieved lower scores for both physical and mental health but also took fewer sick days off work. This probably means these organizations in the software industry do not enjoy the more highly regulated conditions that apply in Australia. In other words, their employees are forced to work while unwell.

The ultimate expression of *motivation*, how people feel about their jobs, was lower in the software industry than the other organizations and this low motivation showed up in the figures for looking for another job. This was higher for the software industry.

These dismal figures for the software industry demonstrate that all the hype and promise of these agile variants tried in this industry, is misplaced. On key outcomes they could not even do as well as a group of DP1 organizations who were on the brink of failing. People do not usually go looking for other jobs without good reason and we know that incomes are above average in the software industry.

The reason is simply that the structures applied in the software industry could not produce higher quality work and jobs. Those that did achieve high quality work are very few and far between.

Despite the fact that the software industry achieved a few scattered individual results better than the other organizations, and not too many worse, demonstrates the cumulative effect that less than adequate overall conditions have on employee motivation. It is not especially worthy of the software industry that it achieved fewer lower scores that these other failing DP1 structures because as we have seen, the outcomes are an indictment of those who spruik theories with no solid theoretical grounding and no empirical data.

Discussion

Our survey has exposed the fragmented and confused landscape of the software industry which the origin and history of the agile movement explain perfectly. Well intentioned technologists, no matter how good at their jobs, are not the people to redesign either organizational structures or processes with structural implications. It is easy now with extensive knowledge of the genotypical design principles to outline the missing organizational knowledge that underlies the agile patchwork with its confusions and problems but in fact that knowledge was hard won over decades. We could not expect these well meaning technologists to intuit the solution to their processual difficulties and they did not.

However, the difficulties they created are manifold touching every aspect of human and organizational behaviour.

The mechanistic belief in independent individuals

The founders of agile like us all were creatures of their culture and their time and leapt to a philosophy appropriate for their broader culture. However, that leap missed the essential element of all human life which springs from our nature as social beings, beings who flourish only when embedded in coherent and supportive structures, and flounder when isolated. Humans are intrinsically social creatures who are immersed in a variety of organizational structures within a complex environment. It follows from this that the basic unit of society is the person-in-environment, an open system (Emery M 2000). As it is in cultures so it is also in organizations. Structures must provide the interdependence employees need both to meet their needs as humans and act to meet organizational goals.

It can be seen from the Agile Manifesto that the prevailing cultural belief was individualism which translated into a single minded pursuit of individual control. Individualism is an indication of a belief that the individual, a person devoid of context, is the basic unit in society. It is a closed systems appreciation of how the world works, an expression of the world hypothesis of mechanism (Pepper, 1942). Unfortunately, this is far too common, blighting much of our social science with its unrealistic descriptions of humankind. The software industry in its current form is merely a reflection of this mechanistic approach.

Failure of coordination

Only a quick survey of the agile literature is required to discover that the most ubiquitous failing is the lack of coordination or 'alignment'. Because the originators of agile had individualism top of mind, so their principles neglected the need for coordination and working together, arguably more important to both people and organizations than individual control. In fact, the best performing organizations in the literature used shared control as well as coordination, that is, they had DP2 structures (Emery M 2008).

The first conventional analysis showed that in the software industry as elsewhere, managers have arranged much better working conditions for themselves than for staff in the lower echelons. It also alerted us to the need to dig much deeper than the design principles to uncover the fundamental and problematic combinations of supervision, coordination and control.

Four cases were kept separate from the managerial and operational samples because they appeared to be working in informal, i.e. non legal self managing groups. The comparison of these four with the managerial and operational samples left no doubt that even though these

four cases were definitely not the real thing, they proved far superior to both the managerial and operational samples. Individual control while potentially beneficial in some ways for employees proved far inferior to informal DP2 structures with low supervision, high coordination and control.

Our detailed investigation by design principle and basic components thereof, confirmed that overall coordination is the weak link in these predominantly laissez-faire samples and confirmed once again that high supervision is highly destructive of both individuals and organizational performance. Control proved the be the only saving grace in all this but only for individuals not organizations and only to a limited degree.

The analysis by critical outcomes served as a cross check on the results above and confirmed both the predominance of laissez-faire and the multitudes of problems it creates. Whether the outcome was motivation, group dynamics or organizational performance, the missing link was coordination. Adequate levels of coordination are required for any sort of sustainable success and its absence is almost a guarantee of poor outcomes.

High control on its own without adequate coordination will never be able to consistently generate the effects necessary for a successful organization with high quality, productivity and innovation in which its employees work together willingly and creatively because they have high intrinsic motivation; they love their jobs.

We suspect that behind agile, the employers and employees who tried to make these combinations work, was an immature idea which could be said to approximate DP2. Whatever they had in mind, it is clear that they had absolutely no idea of what it really was they desired or how to obtain it. The four cases out of 135 or 3% is proof of that. The patchwork of every possible combination of supervision, control and coordination demonstrates complete ignorance of both the design principles and what is required for adequate organizational function. It is no accident that the result is a patchwork of confusions.

Ignorance of 'structure'

Far from escaping DP1, or 'structure' as they hoped, 6.7% of the total were high supervision with low coordination and control, the DP1 combination, while even the most pure form of LF was present with 1.5%. Over a third, 35.6%, of the cases showed a profile approximating DP2 but our results show it is an approximation only, far from the real thing. The rest of the cases are a diverse mixture of strange combinations with a general dearth of coordination, forms of the functional LF observed more widely in North America (deGuerre and Emery, 2008). Apart from anything else, this strange patchwork demonstrates ignorance that there are two forms of 'structure'.

The research was, however, biased towards higher supervision by using the above/below the mean rule for its splits when being supervised only a little closely was included in the high supervision sample. Had this low level of supervision been included in the low supervision sample, the results would have been even more obviously dominated by laissez-faire.

These findings confirm the perception that agile was never really an entity or a well defined set of methods (Fuchs and Hess, 2018). It was assumed in the original four principles that if people followed those principles, good solutions would follow. The movement has, therefore, grown like Topsy with the resultant picture as shown in Table 13.

So in a way those technologists achieved what they dreamt of with their emphasis on individualism but it was as inadequate in the dreaming as it was in its implementation. It shows the confusion that led to the identification of LF in the first place is still with us and still causing mayhem. Perhaps it is time many of the organizational theorists in North America, and abroad, put aside their cultural prejudices and revised their knowledge of the design principles. Then they may be able to provide some constructive advice to such as those struggling to find a way through their organizational problems in the software industry.

Demographics

It was a long time ago that we learnt that individual personality does not play a significant role in organizations. All personalities appreciate DP2, have grave difficulties with DP1 and get confused in various forms of LF. Now throughout these various analyses we have seen that demographics have played only a minimal role in determining outcomes. This puts paid to all the theories about 'human nature' and its many failings, which constantly blame the victims of destructive structures for their poor quality working lives. It is well past time we put these silly theories to bed once and for all as they serve merely to prop up other silly theories such as those applied in the software industry. These theories have evolved from the human relations school which puts the primacy on communication and 'nice' human relationships but has consistently failed to produce adaptive organizations (Emery M 2010).

Failed against failures

Comparing the software industry with the other diverse organizations on our database, which are all DP1 structures at risk of failure, confirmed the quite unique nature of the software sample. It is generally lower on supervision but higher on control and coordination but far from genuine DP2 with a bizarre mixture of high/low combinations of these dimensions. This together with more frequent avoidance of laying blame on anyone when things go wrong and lower accountability in general confirm it as mainly laissez-faire, contributing to its higher turnover.

The software industry shows basic failures of management and although there were higher extrinsic motivators, these could not produce higher motivation any more than they usually do. We really should stop calling them extrinsic or external motivators as their contribution to motivation is fleeting at best. They are evidence of another good theory that failed totally.

There were other patchy benefits for the software industry such as better relationships and trust levels and some amelioration of the effects of inequality but achieving slightly better results than some failing DP1 structures is hardly noteworthy. None of these individual successes could sum to higher levels of intrinsic motivation. In fact, in both individual and organizational terms, the software industry proved inferior to these failing DP1 structures with lower productivity, health and feeling about the job, the overall expression of intrinsic motivation.

No matter how wonderful the technology or its processes, no organization can perform well in the long term without highly motivated productive employees. Agile is not producing them, and that is the finding from a sample of mainly managerial staff who have a more positive view of their organizations than operators.

It is a fairly devastating and dismal indictment of the theories, exaggerated rhetoric and marketing by over enthusiastic proponents. McKinsey's definition of agile: "a network of teams within a people-oriented culture that operates in rapid learning and fast decision cycles

which are enabled by technology and that is guided by a powerful and common purpose to co=create value for all stakeholders" (McKinsey agile tribe, 2017) with its five trademarks sounds more like wishful thinking than reality.

Surely such a huge investment such as agile deserves some excellent advice about the requirement of structural design and the decades of evidence guiding good design.

Conclusions

The software industry is a conglomeration of strange combinations of high and low supervision, coordination and control. By putting the emphasis on control, there was a neglect of coordination, the horizontal dimension of structure which is required to produce organizational results. The resulting patchwork is predominantly LF rather than dominant hierarchies based on DP1, or participative democratic structures based on DP2.

The initiators of agile have, therefore, somewhat succeeded in their attempt to prioritize individuals but in many cases, have done those individuals no favours. Critical indices of healthy, productive workplaces are often too low. Despite adaptive efforts by many within the industry, control has proven insufficient for either personal or organizational health and performance.

Most agile applications have merely imposed the new ideas on quite conventional dominant hierarchies meaning they have mainly failed to remove or even replace DP1 structures. Promoting team autonomy puts agile in direct contradiction to DP1 so inevitably produces conflict in some form.

These uneasy combinations have, therefore, generally not produced well functioning organization either at the operator or managerial levels. There are several failures of basic management function.

After over 20 years of agile, this study shows that agile has failed to produce a coherent industry or sustainable organizations as the critical factors of high intrinsic motivation and organizational performance are in short supply. Highly desirable personal and organizational outcomes are few and far between. In a comparison with other organizations with DP1 structures and in danger of failing, the software industry came off second best.

As these modern forms of laissez-faire are inherently unstable and short-lived and given the importance of this industry into the future, there is a need for a rapid educational campaign about the design principles so the process of organizational redesign can begin to redress its current failings.

Addendum: correcting for skewedness.

In the original paper, all high and low splits were determined by scores above and below the mean as this is the statistically correct procedure to follow. However, while that is an entirely appropriate process for a fairly normal distribution of responses, it can be wildly misleading when a variable is far from normally distributed. This happened to be the case with the critical variable in this study of supervision, where supervision was much lower than is normally found (Table II.1).

Table II.1. Distribution of supervision			
Supervision (Mean=2.4)	*Score*	*N*	*%*
No supervisor or team leader	1	38	28.1
Not closely supervised at all	2	41	30.4
A little closely	3	32	23.7
Reasonably closely	4	12	8.9
Very closely	5	6	4.4
Extremely closely	6	6	4.4

From the original cut off point, we can see that for supervision, 'a little closely' was counted as high because the mean was 2.4. However, 'a little closely' is certainly barely supervised in most people's understanding.

To more accurately describe the nature of the sample in everyday terms, the boundaries have been redrawn to match common meaning with the resulting changes.

Table 13 is copied over from the previous report to contrast with the new figures in Table II.2.

Table 13. Low and high supervision by control and coordination						
	Low supervision		*High supervision*		*Total*	
	N (% of whole)	%	N (% of whole)	%	N (% of whole)	% of total
Low control & coordination	2 (1.5)	2.5	9 (6.7)	16.1	11 (8.1)	8.1
High control & coordination	48 (35.6)	60.9	24 (17.8)	42.9	72 (53.3)	53.3
Low control & high coordination	6 (4.4)	7.6	12 (8.9)	21.4	18 (13.3)	13.3
High control & low coordination	23 (17.0)	29.1	11 (8.1)	19.6	34 (25.2)	25.2
Total	79 (58.5)	100.1	56 (41.5)	100.0	135 (100)	99.9

You can see immediately from the comparison of the two tables that percentage of high supervision examples drops to below 20% of the whole (17.8) which is a significant reduction from the previous 41.5%. 82.2% of the sample is actually low supervision. This really accentuates the degree to which agile and related approaches differ from the normal run of organizations around the world.

All the detailed categories under low supervision are increased but the increases differ in size. The largest, a 200% increase is improbably, for the low supervision, low/low combination which represents the pure LF option. It seems incredible that 6/135 cases could report such a structural profile as it indicates no structure, no organization at all. Such an organization would experience severe difficulties in everyday function as it is nothing but a collection of unrelated individuals.

Table II.2. Low and high supervision by control and coordination						
	Low supervision		*High supervision*		*Total*	
	N (% of whole)	%	N (% of whole)	%	N	% of total
Low control & coordination	6 (4.4)	5.4	5 (3.7)	20.8	11	8.1
High control & coordination	66 (48.9)	59.5	6 (4.4)	25.0	72	53.3
Low control & high coordination	10 (7.4)	9.0	8 (5.9)	33.3	18	13.3
High control & low coordination	29 (21.5)	26.1	5 (3.7)	20.8	34	25.2
Total	111 (82.2)	100.0	24 (17.8)	99.9	135	100.0

The high/high combination with low supervision remains the highest proportion of cases but rose only 37.5%. It is the closest to a DP2 structure but is only its poverty stricken relative as discussed in Part I.

The low control/high coordination and high control/low coordination options which are both forms of the modified LF type prevalent in North America particularly, increased 66.7% and 26.1% respectively. These modified LF combinations can be seen as failed attempted at DP2 but very far short of that. Of all the low supervision options, high control takes a higher proportion than high coordination confirming once again the emphasis placed on control at the expense of coordination.

In terms of the high supervision column, all combinations decreased in frequency but again unevenly. The DP1 option of low control/low coordination reduced by 44.4% to only 3.7% of the whole set while the greatest reduction of 75.0% was for the high control/high coordination combination. This combination is one of those most improbable ones which would be an almost impossible workplace in which to find oneself so the new figures are a slight reassurance that there are actually very few of them.

This reduction in the DP1 option shows that agile has been slightly more successful in avoiding the pure DP1 combination than the figures in part I showed but as we dealt with in detail there, the alternatives it provided are hardly any better.

The mixed combination under high supervision while numerically small illustrate the last point precisely. They may not be DP1 but they are not very different and together amount to over 50% of the high supervision options.

The revised figures for supervision will not significantly affect any of the causal paths documented in Part I. To clarify exactly what differences low and high coordination makes in the low supervision category, the differences between these two largest groups have been calculated. Table II.3 contains the details.

Table II.3 shows that apart from coordination itself, there are 6 critical differences between the high control, high coordination and high control, low coordination categories with low supervision. Everyone is in favour of high coordination.

High scores on the two intrinsic motivators of receiving accurate and timely feedback and mutual support and respect are almost impossible without people working together to both coordinate their work and meet shared purposes. Where there is high coordination we also see much higher intrinsic motivation in general proving once again that coordination is a major factor in this aspect of sustainability. Without motivated staff, organizations can become unstable and experience all sort of difficulties in functioning.

This higher motivation is fed by higher scores on the creative working mode, again contingent on group work, and intellectual satisfaction. Finally organizations with better coordination also provide more adequate training, indicating that these organizations have more competent managements overall. Experienced managers usually appreciate that coordination is a necessary feature of organizational success.

This brief addition to the original analysis, using the revised numbers for supervision, confirms once again that agile had been deficient in recognizing and implementing structures and practices for coordination as a critical dimension of organizational functioning. This is probably because of a mixture of agile philosophy and incompetent or inexperienced management.

Table II.3. **Differences between Low Super, High Control and High Coordination and Low Super, High Control and Low Coordination**

	Levene's test (F)	Sig	t	df	Sig	Mean LS, HC & HC (N=66)	Mean LS, HC & LC (N=29)
Coordination	2.76	.001	15.42	93	.000	4.39	2.76
Adequacy of training	.24	.625	2.10	57.31	.040	3.70	3.24
Feedback	1.82	.18	3.37	48.21	.002	8.58	6.45
Mutual support & respect	2.05	.155	2.09	48.72	.042	8.12	7.10
Creative working mode	.049	.826	2.58	57.41	.012	7.36	6.55
Intrinsic motivation	.001	.98	2.20	55.05	.032	65.71	60.55
Intellectual satisfaction	.694	.407	2.67	48.26	.01	33.0	30.52

References

59 seconds. Agile history – how did agile project management start? https://www.59secondsagile.com. Accessed 8.1.23.

Agile (2001) Manifesto for Agile software development. https://agilemanifesto.org. accessed 16.11.22.

Bion, W. R. (1952). Group dynamics: A review. *International Journal of Psychoanalysis, 33*, 235-247.

Bion, W. R. (1961). *Experiences in groups*. London: Tavistock

Cagle Kurt. (2019). The end of agile. Forbes. https://www.forbes.com. 6.1.23.

deGuerre, D.W., Emery, M, Aughton, P, Trull, A.S. (2008). Structure Underlies Other Organizational Determinants of Mental Health: Recent Results Confirm Early Sociotechnical Systems Research. *Systemic Practice and Action Research*. 21. 359-379.

deGuerre DW, Emery Merrelyn. 2008. Modern forms of laissez-faire organization. Laissez-faire. www.socialsciencethatactuallyworks.com.

Emery, F. (1967). The next thirty years. *Human Relations, 20*, 199–237. Reprinted with postscript in *Human Relations* (1997), 5*0*(8), 885–935

Emery Fred, 1974. Adaptive systems for our future governance. In Emery M (Ed) 1993, pp185-199

Emery, F. (1976a). The jury system and participative democracy. In M. Emery (Ed.), *Participative design for participative democracy* (pp. 207–211). Canberra: Centre for Continuing Education, Australian National University

Emery, Fred (1976b) Adaptive Systems for our Future Governance. *National Labour Institute Bulletin*, Vol. 2 No. 4 and Occasional Papers 4/76, New Delhi. Also under Democracy throughout the system. www.socialsciencethatactuallyworks.com.

Emery F E, 1976c Causal path analysis. In Emery F (Ed) 1981. Systems thinking. Vol. I. Penguin. 293-298

Emery, F. (1977). *Futures we are in.* Martinus Nijhoff. Leiden: Revised and updated. *Futures We're In*. (1998). www.socialsciencethatactuallyworks.com.

Emery, Fred (980) Communications for a Sustainable Society: Year 2000. *Human Futures.* Autumn.

Emery, F. (1989). *Toward real democracy and towards real democracy: Further problems*. Toronto. Ontario Ministry of Labor; *Per una democrazia della partecipazione*. Torino. Rosenberg & Sellier. 1990

Emery Fred and Emery Merrelyn. 1974 'Participative Design: Work and Community Life'. In Emery Merrelyn (Ed) 1993. *Participative Design for Participative Democracy*. Canberra. Centre for Continuing Education, Australian National University. 100-122

Emery, F. & Emery, M. (1976). *A Choice of Futures.* Martinus Nijhoff. Leiden

Emery, F. and Thorsrud, E. (1969). *Form and Content in Industrial Democracy*. Tavistock. London

Emery, Fred and Thorsrud, Einar, 1976, *Democracy at work*. Leiden. Martinus Nijhoff Social Sciences division

Emery, F. E. & Trist, E. L. (1965). The causal texture of organizational environments. *Human Relations,* 18: 21-32

Emery M. (1999). *Searching: The theory and practice of making cultural change.* Amsterdam & Philadelphia: John Benjamins

Emery, M. (2000). The current version of Emery's open systems theory. *Systemic Practice and Action Research, 13*(5), 623–643

Emery M, (2003). Are there universal principles governing architecture in the mechanical, biological and social realms? The evidence so far. In *Conference Proceedings, 9th ANZSYS Conference, Systems in Action,* 18-20 November, ANZSYS 2003. Monash University Conference Managing Office, Melbourne

Emery, Merrelyn. (2004). Open systems theory. In Boonstra, Japp J. (Ed), *Dynamics of organizational change and learning* (p. 43-69).Chicester, UK: John Wiley and Sons

Emery, Merrelyn. (2006). Notes on conceptualization (final). www.socialsciencethatactuallyworkss.com.

Emery, M. (2008). The far reaching effects of the design principles. Genotypical design principles. www.socialsciencethatactuallyworks.com.

Emery, M. (2010). When the cure is the cause. *The Innovation Journal: The public Sector Innovation Journal.* Vol 15(1). Article 6.

Emery, M. & Aughton, P. (2006). *Organization health and innovation survey.* Melbourne: Amerin

Emery, Merrelyn & deGuerre, D. W. (2007). The design principles and laissez-faire: logic and pure and applied forms. Laissez-faire. www.socialsciencethatactuallyworks.com.

Fuchs Christoph. (2019). Adapting to agile methods: exploring the interplay of agile methods and organizational features. Proceedings of the 52nd Hawaii international Conference on System Sciences. Abstract, p7027.

Fuchs Christoph and Hess Thomas (2018). Becoming Agile in the digital transformation: the process of a large-scale Agile transformation. Conference proceedings of the 39th International Conference on Information Systems (IC18, 2018). www.researchgate.net. Accessed 13.1.23.

Gustavsen Bjorn (1987) The law and organization of work: The Norwegian work environment act art. 12. Quality of Work Life. 4(1–2): 95–110

Kanbanize (2019) Why agile doesn't work in every case and what are the top agile challenges. https://kanbanize.com. 8.1.23.

Kniberg Henrik and Ivarsson Anders. (2012). Scaling Agile at Spotify. https://vdocument.in.

Lippitt, R. (1940). An experimental study of the effect of democratic and authoritarian group atmospheres. *University of Iowa Studies in Child Welfare*, *16*(3), 43–195.

McKinsey agile tribe. 2017. The 5 trademarks of agile organizations. McKinsey and company. www.mckinsey.com.

Miller GJ (2013). Agile problems, challenges and failures. Paper presented at PMI Global Congress 2013, N. America, New Orleans. Project Management Institute. Accessed 8.1.23.

Moe NB; Smite S; Paasivaara M; Lassen C. (2021) Finding the sweet spot for organizational control and team autonomy in large scale agile software development. Empirical Software Engineering. 26(5): 101. https://doi.org.1007/s10664-021-09967-3.

Rigby Darrell; Sutherland Jeff; Takeuchi Hirotaka (2016) Secret history of agile innovation. Harvard Business Review. https://hbr.com, Accessed 7.1.23.

Sacolick Isaac. (2022). A brief history of the agile methodology. Info World. https://www.infoworld.com. Accessed 8.1.23

Serrador Pedro and Pinto Jeffrey K. (2015). Does agile work? International Journal of Project Management 33(5) 1040-1051. Abstract only. https://www.sciencedirect.com. Accessed 9.1.23.

Sletholt Magnus Thorstein; Hannay Jo; Pfahl Dietmar; Benestad Hans Christian. (2011). A literature review of agile practices and their effects in scientific software development. SECSE'11 May 28. Waikiki, Honolulu, Hawaii, USA.

von Bertalanffy 1950. The theory of open systems in physics and biology. In Emery F (Ed) Systems thinking 1981, Vol I. 83-99

Trist, E. L. and Bamforth, K.W. (1951). Social and psychological consesquences of the longwall method of coal-getting. *Human Relations*, IV, 1, 3-38.

Winby Stu. (2022) Designing for organizational agility. Emergence. Vol 3(4). Business Agility Institute.

Zippia (2022a) Software developer demographics and statistics in the USA. https://www.zippia.com. Accessed 16.11.22.

Zippia (2022b) Software engineer demographics and statistics in the US. https://www.zippia.com. Accessed 16.11.22.

Appendix A

Constructed scales

Table A1. Scale construction	
Constructed scales	***Components***
Intellectual satisfaction	Mental demand + sense of achievement + learn on job + teach on the job + -knowledge not used + know business results + trained for job
External motivators	Secure job + Innovation rewarded +Satisfied with pay + Satisfied with conditions + Good OHS
Relationships & trust	Relate up + Relate general + Trust peers + Trust up
Positive affect	-bored + excited + interested + joyful + energetic + creative + confident + respected
Fear for safety (Negative Affect1)	Afraid + -safe + despairing + depressed + anxious + stressed + lonely + tired
Effects of inequality (Negative Affect2)	Put down + powerless + angry + frustrated + disgusted + trapped
Health	Physical + mental
Blame management	Management and TLCs accountable
Organizational performance	Innovative + productive + quality + accountability + appraisal frequency + appraisal fair
SES	Income + position
Set scales	
DP1 – measure of first design principle	Super + -control + -coordination +individual accountability (minus Teamtype)
DP2 – measure of second design principle	-super + control + coordination + group accountability (minus Teamtype)
LF – measure of laissez-faire	-super + nobody accountable (minus Teamtype)
Basic assumption of fight/flight (BaF)	Cliques + Playing politics + Gossip
Basic assumption of dependency (BaD)	Reluctant + Ignored + Give up + Wait
Creative working mode (CWM)	Creative + celebrate

Appendix B

Tables of difference

Table B1. Differences between operational and managerial samples							
	Levene's test (F)	Sig	t	df	Sig	Mean Ops	Mean Mgt
Control	7.26	.008	-3.6	129	.000	4.61	5.38
DP1	.204	.65	2.04	78.57	.045	11.69	12.17
DP2	.999	.32	-3.07	75.55	.003	14.86	16.63
Mutual support & respect	.004	.95	-2.51	87.22	.014	6.61	7.66
Individual criteria	5.42	.02	-3.10	129	.002	31.14	35.18
Climate criteria	.56	.46	-2.69	98.48	.009	23.5	27.0
Intrinsic motivators	5.42	.021	-3.10	129	.002	54.64	62.18
External motivators	.26	.614	-2.30	88.97	.024	18.8	20.21
Intellectual satisfaction	.105	.746	-3.46	77.52	.001	28.86	31.89
CWM	.058	.81	-2.53	86.84	.013	6.39	7.06
Feel about job	.889	.35	-2.36	81.43	.02	3.3	3.72
Trust subordinates	15.77	.000	-4.81	129	.000	1.95	3.78
Income	3.83	.05	-3.33	129	.001	6.52	7.67
SES	1.45	.23	-7.64	73.02	.000	9.14	12.17

Table B2. Differences between self managing group and managerial samples							
	Levene's test (F)	Sig	t	df	Sig	Mean Smg	Mean Mgt
Control	1.75	.189	5.01	4.3	.006	6.75	5.38
Mutual support & respect	2.69	.104	3.91	4.72	.013	9.75	7.65
Social value	1.69	.197	3.11	4.14	.034	8.5	6.32
See whole	2.84	.096	3.53	4.16	.023	9.25	6.84
Other job	12.23	.001	-2.28	89	.025	1.0	2.53
Sick days	4.14	.045	2.00	89	.048	3.25	1.95
Occ status	2.59	.111	3.69	86.0	.000	7.0	6.47
Feel about job	7.99	.006	2.71	89	.008	5.0	3.72
BaD	1.54	.218	-3.11	3.94	.037	7.50	10.38
Fear safety	2.09	.152	-5.02	4.16	.007	10.5	18.97
Effects Inequality	3.59	.061	-9.22	12.31	.000	6.75	13.09

Table B3. Differences between self managing group and operational samples							
	Levene's test (F)	Sig	t	df	Sig	Mean Smg	Mean Ops
Control	4.55	.038	3.12	46	.003	6.75	4.61
Variety	2.75	.11	2.74	7.04	.029	10.52	8.8
Desirable Future	.89	.351	3.03	4.02	.039	8.0	5.02
Social value	2.47	.123	3.92	5.06	.011	8.5	5.61
Mutual support & respect	2,71	.11	5.36	6.59	.001	9.75	6.61
See whole	1.86	.179	4.07	5.61	.008	9.25	6.25
Other job	13.26	.001	-2.39	46	.021	1.0	2.75
Occ status	2.29	.137	2.32	43.0	.025	7.0	6.61
Feel about job	11.15	.002	3.37	46	.002	5.0	3.3
BaD	2.19	.146	-3.27	5.29	.02	7.5	10.78
Fear safety	2.00	.153	-5.02	5.54	.003	10.5	19.61
Effects Inequality	4.15	.048	-7.92	24.24	.000	6.75	13.68
Climate criteria	3.30	.076	7.22	7.3	.000	35.5	23.5
Intrinsic motivators	2.22	.143	4.22	5.5	.007	74.0	54.64
External motivators	.51	.48	3.67	4.3	.019	23.25	18.8
Intellectual satisfaction	1.35	.251	4.40	5.42	.006	35.25	28.86
Supervision	6.39	.015	-2.56	46	.014	1.0	2.8
DP1	.794	.378	-3.33	4.82	.022	7.5	11.09
DP2	.579	.451	4.28	4.51	.01	19.75	14.86
Climate criteria	2.91	.092	5.45	5.79	.;002	35.5	27.0
Intrinsic motivators	.91	.343	2.86	3.64	.051	74.0	62.18
SES	2.86	.094	-6.60	4.14	.002	8.75	12.17
Supervision	6.67	.011	-2.06	89	.043	1.0	2.33
DP2	.262	.61	2.90	3.53	.051	19.75	16.63

Table B4. Structural differences between other organizations (N=636) and software industry (N=135)							
	Levene's test (F)	Sig	t	df	Sig	Mean other	Mean software
Supervision	2.57	.11	4.31	186.71	.000	2.99	2.44
Control	5.85	.02	-4.93	769	.000	4.55	5.17
Coordination	1.57	.21	-2.63	201.98	.000	3.52	3.76
Blame individuals	16.51	.000	10.49	769	.000	3.67	2.70
Blame management	2.97	.09	2.50	193.31	.013	2.84	2.59
Blame TLC/ S1*	1.09	.30	6.36	195.42	.000	3.22	2.64
Blame team as whole	5.64	.018	5.35	769	.000	3.16	2.66
Blame nobody	8.69	.003	2.62	769	.000	2.11	2.94
Accountability	4.76	.029	2.62	665	.009	3.27 (532)#	3.03

*where TLC/S1 is team leader, coach or first line supervisor

#where number in bracket is number of cases.

Table B5. Differences between demographics in other organizations and software industry (N=135)							
	Levene's test (F)	Sig	t	df	Sig	Mean other (N)	Mean software
Age	32.00	.000	-5.52	683	.000	3.31 (550)	3.90
Education	16.26	.000	-16.18	683	.000	3.51 ("")	5.32
Income	27.06	.000	-26.73	683	.000	3.16 ("")	7.30
Position in hierarchy	.363	.55	-16.14	188.33	.000	2.28 ("")	3.87
Years in organization	10.60	.001	2.21	656	.027	3.11 (523)	2.76

Table B6. Differences between enabling conditions in other organizations and software industry (N=135)							
	Levene's test (F)	Sig	t	df	Sig	Mean Other (N)	Mean software
Cognitive aspects							
Mental demand	24.69	.000	-7.43	792	.000	3.47 (659)	4.16
Training adequate	13.76	.000	5.97	395	.000	4.24 (262)	3.34
Knowledge not used	7.84	.005	-11.27	665	.000	222 (532)	3.90
Sense of achievement	.437	.509	-3.47	196.61	.001	3.43 (555)	3.76
Extrinsic motivators							
Reward for innovation	2.91	.089	-4.87	185.68	.000	2.51 (532)	2.99
Security of job	2.07	.151	-10.30	270.19	.000	2.92 (202)	4.06
Satisfaction pay	.709	.40	-7.03	214.81	.000	3.21 (532)	3.88
Satisfaction conditions	.392	.531	-7.01	189.77	.000	3.50 (")	4.23
Relationships and trust							
Trust between equals/ peers	1.96	.162	-5.79	177.78	.000	4.29 (532)	4.87
Trust subordinates	.433	.511	-3.80	218.69	.000	3.56 ("")	4.07
Relationships generally cooperative	.113	.737	-2.55	194.51	.012	3.63 ("")	3.84
Group dynamics							
Fight/flight (baF)	5.15	.024	5.73	3.89	.000	9.58 (256)	7.58
Jog along (baP)	6.10	.014	-3.68	7.92	.000	2.91 (659)	3.21
Creative mode (CWM)	.019	.891	-6.91	191..45	.000	5.89 (659)	6.87
Affects							
Excited	.112	.738	-4.36	217.14	.000	2.90 (555)	3.25
Creative	5.05	.025	-4.78	688	.000	3.01 (")	3.42
Powerless	1.68	.195	3.76	198.47	.000	2.78 ("")	2.38
Humiliated	.158	.691	3.64	216.48	.000	1.98 ("")	1.66
Effects of inequality	1.76	.185	1.94	235.26	.05	14.02 (293)	13.10
Intrinsic motivators							
Variety	14.95	.000	-2.34	1046	.02	8.48 (913)	9.11
Elbow room	14.88	.000	-2.11	1046	.036	8.34 (")	8.93
Set goals	12.08	.001	-2.23	1046	.026	8.42 (")	9.02
Mutual support & respect	5.47	.02	-3.10	1047	.002	6.62 (914)	7.38
Social value	.044	.835	5.70	172.47	.000	7.38 (913)	6.16

Table B7. Differences between outcomes in other organizations and software industry (N=135)							
	Levene's test (F)	Sig	t	df	Sig	Mean Other (N)	Mean software
Quality	36.31	.000	-2.51	463	.012	4.23 (339)	4.48
Productivity	15.71	.000	6.54	665	.000	4.97 (532)	4.23
Physical health	.645	.422	4.14	250.89	.000	3.60 (225)	3.18
Mental health	12.95	.000	4.41	426	.000	3.69 (293)	3.25
Sick days	.117	.732	2.47	198.63	.015	2.39 (555)	2.08
Feel about job (Motiv)	7.10	.008	2.81	792	.005	3.86 (659)	3.62
Look other job	31.51	.000	-5.21	285	.000	1.82 (152)	2.56