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Seven Well Known Fundamental Flaws Against Innovations in Construction Chemistry

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Abstract. Construction chemistry is underdeveloped compared to other chemical branches. Innovation is realized by new products, improved processes or / and more efficient organization. Innovation becomes evident when a noticeable progress is achieved by implementing changes. There are seven fundamental hindrances or flaws possible which are briefly considered. The state-of-the-art must be known. Innovation is measured in comparison to this state-of-the-art. If this level is not yet attained, progress is easily realized by introducing the actual knowledge. The realization is measured according to qualitative or preferably quantitative benchmarks. Unfortunately, this is not currently done in the field of construction chemistry. Before benchmarking starts, communication based on truth and trust must be effective. The available scientific methodology must be known. Benchmarking will possibly show deficiencies in education and training. This will stress the need for adequate transparency to improve efficiency. Hopefully, a self-regulating process improving products and processes will be created in this way.

Introduction

Stuff for thinking: The seven flaws may be exemplified by a coating of a concrete floor of 3.000 m² with a value of 90.000 €, defective on only 5 % of its total surface. i.e. 150 m², caused by blisters, probably from humidity from the ground. Finally, a financial and practical solution to the problem was found by mediation after eight years of litigation.

A costly disaster on only 150 m² of 3.000 m². Only 5 % of the surface was concerned. There were some thirty questions to experts.

Example: Disaster by an earthquake. Most houses are intact, others are destroyed: How could it happen this way? Is there causality?

There are seven well known fundamental flaws, which will be briefly treated:

1 Communication
2 Methodology
3 Benchmarking
4 Formation or education
5 Training
6 Transparency
7 Efficiency

Do we need legal protection for subcontractors? My answer is no – but we need responsible people.

This is a key to knowledge management in the crafts.

As a conclusion I will indicate further reading. Remarkable and concise sources of knowledge, you need to overcome these difficulties using also the common sense of your people. Special attention is drawn to «ICRI Vision 2020» [1].

1st Flaw: Communication or Consequences of Errors

1 Spectacular … mistakes are only the top of the iceberg.
2 About 5 % of all … errors have lethal consequences.
3 Autopsies showed for a quarter of all cases grave mistakes in diagnostics.
4 The questions don't only consider the background of failures but also the strategies used for solving the problems.
5 About 80 % of errors were due to human failure.
6 Mostly a chain of critical events caused the disaster.
7 In spite of intensive endeavour of several scientific specialists, the medical profession is far away from severely enforced risk-management.
8 Errors are ignored or the causes are sought in others.

Also the application of high performance polymers by skilled crafts necessitates a strongly enforced risk-management, e.g. with a register at the Internet [2].

2nd Flaw: Methodology: The Scientific Method

According to Descartes (1596-1650) there are four principles*:* evidence, reduction, increasing complexity and reproducibility - e.g.

- Define the question
- Gather data and observations
- Form a hypothesis
- Perform an experiment and collect data
- Interpret data and draw conclusions

What defines a good theory? In *The Rationality of Science* the philosopher W. Newton-Smith names eight key features:

(1) Observational nesting: The ability to explain the successes of its predecessors.
(2) Fertility: The ability to generate new ideas to guide future research.
(3) Track record: Its achievement in making correct predictions in the past.
(4) Inter-theory support: The ability to provide additional evidence in favour of another theory.
(5) Smoothness: The theory needs few auxiliary hypotheses to explain its failures.
(6) Internal consistency: It contains few statements that lead to the acceptance of logically incompatible predictions.
(7) Metaphysical compatibility: It meshes well with our beliefs, including our general metaphysical position.
(8) Simplicity: A version of ‚Occam's Razor' which says that, when all other things are equal, simpler theories are to be preferred, if only they are easier to compute.

The basis of this argument is that, if we apply these criteria carefully, the growth of knowledge will proceed in a genuinely rational way [3].

The work of scientists according to Robin Dunbar [3] concern with the understand how and why the world is as it is, and if this takes five hundred years of collective effort by a thousand individuals scattered in laboratories all around the world, only a handful of whom ever actually get to meet, then so be it.

Success in science comes only from a long slow methodical working through of all the ins and outs of a very complex phenomenon, checking and double-checking everyone else's calculations, because only by patience and careful testing will we avoid mistakes.

As the history of science all too often reminds us: nothing is gained by over-hastiness [3].

Already Aristotle said (De Generatione Animalium (c. 330 BC) cited by [3]): If in any future time [the facts] are ascertained, then credence should be given to the direct evidence of the senses rather than the theories.

3rd Flaw: Benchmarking

Innovation comes with (1) new products, (2) improved processes or/and (3) more efficient organization. Innovation becomes evident when a noticeable progress is realized by implementing changes. Progress is measured against the actual *state-of-the-art*. If this level is not yet attained but known, then progress is easily attained by adopting the state-of-the-art. The realization of this goal is measured by quantitative and qualitative benchmarks. Based on the benchmarking process, *requirements* that are not met by existing products, processes or organization are developed. Thus, demands on further research and development are established for further progress.

Paramount for any progress are *open minded people* with an up-to-date knowledge of actual methods capable to bridge an existing knowing-doing-gap. Therefore goals in *education* and *training* are the two other flaws to be considered.

4th Flaw: Education

Again I want to quote Robin Dunbar [3]: What is clearly required is a much greater awareness of science, and that requires more and better science education.

In the sciences you need an information pack before you can start to discuss anything, and those tools may have to be acquired by rote learning before you can do something with them … It might be that there are simply no real alternatives to rote learning: tennis stars after all, are not made overnight, but by hours upon hours of tediously repetitious practice [3].

Our deepest problem remains trying to present the human face of science. It is clear that much of the school science curriculum … is boring and hard work.

Sheer rote learning is often enough to earn the highest grades. Now memory capacity is as important in science as elsewhere, but if qualifications are simply a measure of individuals' memory capacity, then the future does not bode well. Science depends on inspired guesswork and imaginative thinking as much as on anything else [3].

5th Flaw: Training

Even well-trained and intelligent employees fail to recognize the fact that information including research on the Internet and talk with colleagues does not necessarily qualify as reliable knowledge. «Knowledge» means information which <u>can</u> be used for action, whereby the emphasis is on «<u>can</u>». This must be taken into account by quality management so that it is possible to proceed according to the nine rules which Daniel Benor introduced in his team for the World Bank in order to increase the yield of harvests in developing countries with options of a hunger catastrophe:

Nine rules for training

1 Plain pragmatism
2 Tight organization
3 Concentration of forces
4 Constant monitoring of success
5 Training every fortnight
6 Fixed schedule
7 Learning by doing
8 Few manual actions
9 Few rules to remember

Benor also held the view: If the farmers don't follow a recommendation, it was a bad one. The farmer is always right.

Learning from doing: There are limitations, as David S. Landes tells us for the UK in 1880: Here the British were late in exploiting newer fields and ways, stressing - instead - learning by doing, in the shop and at the bench. Such job apprenticeship has its virtues and successes, but nothing is better calculated to preserve the old aspic and miss the opportunities of innovation.

6th Flaw: Transparency

Money loves transparency: Without transparency, no investment decision can be made. That is why so many floors are simply left with their defects.

Example: Imagine you must repair the floor of a production unit of 1,000 m^2. Your liability insurance has already set the end of the year as a deadline because of accidents caused by tripping or stumbling. Your fork-lift trucks need repair more frequently. And your sales staff complains about the dust covering your otherwise immaculate, beautifully finished products. They can even write their names in the dust. What should you do? What decision should you take? First of all, you need information.

Information is available everywhere in excess. You don't necessarily have to use the Internet, although it expands the flood of information incredibly.

Chance: When faced with repairing this floor, you feel overwhelmed by the sheer volume of unstructured information. There is no transparency in the market. But if you cannot form your own opinion, you are dependent on people you trust, or else you are at the mercy of chance, e.g. whatever colourful brochures the postman happens to deliver to your desk. Nobody tells you that there are only a small number of floor applicators that have been on the market for more than ten years. Specialist firms come and go if they are not well managed, or if they are unlucky...

Trust: I can trust the architect who happens to be a friend of mine. He confesses to being overwhelmed by the plethora of data from the 100 competitors in my country. Nor would he know who should do the job: the painter around the corner, the building contractor, or even a specialist? What about the credentials of these companies?

Market leaders: My friend helps by referring me to one of the market leaders. After a wait of two weeks, this firm sends me a so-called «consultant», free of charge. He does his level best, on his meagre sales commission, to do the job of an expensive expert. Possibly he is not really qualified for the job anyway. Floor diagnosis may even be a foreign concept to him. And he may never have heard of test surfaces which are customary in corrosion protection.

Result: My floor gets repaired, but I don't know whether for my requirements

- it is the correct, optimum system
- the right products have been used
- the products have been applied correctly
- the price is reasonable and transparently calculated
- the repair offers an adequate warranty.

No «instructions for maintenance» are provided. It then crosses my mind that the repair itself may soon need repairing.

Dialogue: It would be necessary that a detailed, objective and open discussion is stimulated by all people concerned.

7th Flaw: Efficiency and Subsidiarity

Principle of Efficiency: Use of scarce resources. All goods and services in a society are produced by work. Wether a machine or a person is doing the work, time has been expended if time and personal energy are required to create goods and services, no individual should waste resources. He should marshal his time carefully and make *effective* use of the goods and services available to him; he should also be concerned that other people do not waste resources, which either he or future generations may wish to use.

Natural resources, personal effort, and goods and services should *not be wasted without reason* [4].

Principle of subsidiarity: Managing with subsystems. The fact that people differ in abilities and aspirations … require that the individual, to the extent feasible, should be allowed to pursue the basic goods in the manner she chooses. When the group must make a collective decision and cannot defer to the individual, the group should be as small as possible, since this allows the group to

weigh the needs, abilities, and aspirations of members of this group. Furthermore, if the group functions efficiently, the group decisions reflect the views of *most* people in the group.

The coordination and organization of humans and their activities should be designed so that *the smallest feasible group regulates its own affairs* [4].

Conclusion

Many *Open Questions* on industrial floors: Interrelationship between adhesion and cohesion. *Data basis* of six international colloquia on «Industrial Floors» and twelve ICPIC Congresses since 1975. The problem of government *funding* and its *bureaucracy***.**

Innovations cannot be forecasted: Innovations need firstly leisure time and thus money. *Trust and confidence***:** The selfish world of Thomas Hobbes / Adam Smith. A world of justice and order: Aeschylus (485 BC)

Future technical trends and expected improvements [1]**:**

1 Concrete slabs on ground without joints / cracks
2 Cost effective cementitious repair mortars
3 Very thin polymer repair mortars
4 Durable and strong interfacial adhesion between impregnation / coating / topcoat
5 Influence of humidity from ground without damage on coatings (osmosis)
6 Practical relevancy and cost-effective testing
7 Systematic investigations in defects / damage
8 Characterisation of materials and systems
9 Review of regulations, standards and guidelines according to their relevancy and their costs.

References

[1] P. H. Emmons and D. J. Sordyl, The state of the concrete repair industry, and a vision for its future (Vision 2020), in: *Concrete Repair Bulletin*, (ICRI / ACI, 2006), 7-14, www.icri.org/GENERAL/Handout-Vision 2020.pdf

[2] CIRSmedical. https://www.cirsmedical.ch/cug/CIRSmed_D.pdf, accessed 31.08.09.

[3] R. Dunbar, *The Trouble with Science* (1995).

[4] J. J. Piderit, *The Ethical Foundations of Economics* (1993).