

THE HAZARD OF MANAGEMENT

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When engineers get onto the topics of hazards, risk, safety, reliability and related matters the thinking generally revolves around the physical equipment which engineers design and build, and operate and maintain, and manage to some extent. Any discussion may, then, progress to processes and from that to procedures and policies, into the areas where more general management is involved. But consideration of those matters rarely extends as far as management itself, to whether the management system and the people in it are sufficiently hazard-free and reliable to minimise risk.

Why should we look at management as a possible hazard? There is evidence suggesting some serious incidents are related to management, which raises another, following-on, question: why should management be, or present, hazards? The answer is simple, much of management activity is performed by using judgement, which is not a truly reliable practice and provides opportunity for error, and a research project has shown that there are several often-occurring, quite “normal”, conditions which readily cause managers to make mistakes.

The paper based on this abstract will discuss how management judgement affects management reliability, and how that might be improved. It will conclude by presenting a very recent real and tragic event caused by application of apparently-sound judgement which results showed was incorrect.

WHAT DO MANAGERS DO?

One of the amusing memories of being a manager is having a young (and inquisitive) child ask: “What do you do at work, Daddy?” An honest answer, from one who was a manager in a chemical manufacturing firm, is something like: “I walked around quite a lot, and I talked to people, and I did some writing, and, oh, yes, I had lunch, then I went back to my office and did a lot of phone calls, more writing, more talking to people. Does that give you an idea of what my day was like?” The child’s answer first displayed serious understanding, then produced a shattering question: “Do you mean you get paid for doing just that?”

There’s more to management than that, of course, and if we go to any of the management texts we find that managers plan, organise, lead, and control, with varying details added by some, such as “staffing” on organise and “motivating” on lead (eg Stoner *et al*, 1985). Whatever, however they may be stated, those are accepted as the classic functions of management. And behind, within, and surrounding those there’s decision-making, which really is the core or central function of management.

Making decisions is something mysterious which, it seems, only humans do. The tasks related to it, problem-solving and problem-*finding*, usually “just happen”, particularly for engineers: problems seem to find us, rather than the opposite. This combination, problem-finding-and-solving, can be the step leading up to decision-making. The reason for putting that in such a way: “the step leading up to decision-making”, is that one can’t make a decision until one knows what the problem is, and what are the alternative solutions - - -

without a problem and alternative solutions, there's no need for a decision. Both, a problem and alternative answers, are necessary as a lead-up to making a decision.

If a problem exists and a solution is demanded, and there's only one answer, no decision is needed. Or possible.

There is, actually, a very close link between problem-solving and decision-making; the two are very hard to separate from one another, and there's a very strong impression that some authors refer to one when they mean the other. Harrison (1987) stressed this difference by pointing out that decisions can often be made and implemented successfully in the absence of problems, and problems can be identified and solved without decisions. However, there is a one-way connection, in that solving a problem (by identifying possible solutions) may lead to a decision having to be made, but the reverse does not apply.

Other animals, certainly, can solve problems, but it does seem that only humans do this other act. There is a big difference between the two, problem solving is *finding an answer* (dogs and cats and, of course, monkeys have been seen to do that), but decision making is *choosing between alternatives* (and that seems to be the *homo sapiens* thing).

WHAT IS DECISION-MAKING?

Definitions abound. Going way back into the past we find many examples of what writers believe decisions, and decision-making, to be. For example, Cooper (1961) gave us:

Decision - is a commitment to action. Examples of action are the giving of an order to a subordinate, the signing of a letter to a customer to inform him of the terms on which the company will accept a contract, etc.

A decade more recently, another, somewhat different, was given by Massie (1971):

- a course of action consciously chosen from available alternatives for the purpose of achieving a desired result.

That spells out an important factor. Without alternatives, no decision is needed or can be made; there must be a reason for making the decision, which is to make a selection from among the available alternatives so that the desired result can be reached.

Also, the alternative selected must be "consciously chosen". Very often, even in large organisations, decisions are made "by default", that is, procrastination is allowed to set in and time is allowed to slip by so that finally events either make the decision or force the choice. Such is *not* decision-making. The "default choice" was around for a long time, well before the computer was invented.

Massie (1971) also pointed out there are three important ideas associated with decisions:

1. A decision involves a choice between alternatives; if there are no alternatives, then no decisions are required or can be made.
2. A decision involves mental processes at the conscious level, processes which contain important logical aspects and these suggest that decisions should be "rational". However, there are also emotional and sub-conscious factors which may not be consciously expressed and which may make a decision appear to be non-rational to an observer.

3. A decision is purposive, to attain some objective; that is, there is a reason for making it.

In the first numbered paragraph above there's reference again to the need for alternatives. Finding a reasonable range of alternatives from which to choose is the sort of activity that trained engineers do well, because that's really part of problem-solving, and our technical education system teaches that, but taking the next step, selecting which alternative to use, is the decision-step.

TYPES OF DECISIONS

The above suggested a uniformity of decisions, but that's not so, there's very real diversity of types, so we need to consider those different types of decisions which can be (and are) made.

Using another voice from the past, Drucker (1963) pointed to four characteristics which have a bearing on the nature of a business (or management) decision:

1. The degree of futurity of the decision. (In a short article titled "The Aphorisms of Peter Drucker" he stated: "Long range planning does not deal with future decisions, but with the futurity of present decisions.")
2. The impact of the decision on other functions, or departments, divisions, etc. in the organisation. (He advised: don't shake others up, well, not *too* much.)
3. The number of qualitative factors in it, such as principles of conduct, ethical values, social and political beliefs, etc. (This is referring to values as distinct from facts.)
4. Whether the decision, as a type, is periodically recurrent, or rare, or even unique.

Radford (1975) classified decisions under a number of headings which overlap, in some cases, those already mentioned above but are worth reviewing. He also pointed out that his classifications are not necessarily mutually exclusive, and a particular decision may have characteristics from more than one class. These characteristics of a decision may be:

- (a) routine, well understood, and documented in all of its aspects, or it may be such as to require human involvement and judgement at one or more stages of the process,
- (b) involve well-defined quantitative parameters, such as money, or it may refer to matters for which numerical values or outcomes are difficult to define (such as health and welfare),
- (c) undertaken against a background of certainty in terms of the outcome of any course of action chosen, or in the face of uncertainty with regard to future events or the actions of others,
- (d) such that well-developed mathematical techniques can be applied, or it may be that no well-defined structure has been developed for a problem of its type,
- (e) a problem existing and requiring a solution at one point in time, or it may consist of a sequence of inter-related decisions,
- (f) such that it can be resolved by an individual acting alone, or it may be the responsibility of a group of individuals who may not have identical views and approaches with regard to the problem,

- (g) arising in a small community of individuals, or in a large organisation consisting of a number of sub-groups with divergent interests.

Ansoff (1968) divided decisions into three general classes:

Strategic - centralised, made in partial ignorance, non-repetitive, very future-oriented.

Administrative - largely concerned with resource-allocation and the resolution of conflict between differing objectives.

Operating - decentralised, repetitive, large volume, need to sub-optimize forced by complexity.

As a broad classification, many writers (Stoner *et al*, 1985, for example) classify decisions as programmed and unprogrammed. The Radford Type (a) is clearly the “programmed” decision, as is Ansoff’s reference to some decisions being repetitive. Drucker’s fourth characteristic above deals with the same distinction, which he expanded to show the difference between programmed and unprogrammed decisions:

- (i) programmed decisions are routine or repetitive, to the extent that a definite procedure has been worked out so that this can be applied every time the specific situation arises,
- (ii) unprogrammed decisions are unique, novel, and hence unstructured, with no cut-and-dried method for handling the particular situation because it hasn’t arisen before, or because its precise nature and structure are elusive and complex, or because it is so important that it deserves a custom-tailored treatment.

In actual fact, in practice, very, very few decisions are either one type or the other; most have an element of each in them.

On this point, Radford drew attention to how the “experienced manager” “cheats”: when an organisation decision is repeated, even with some minor variations, the manager facing it has an opportunity to vary and correct his methods and approach so that the result becomes closer and closer to being “right”. That is, he has appeared to perform an unprogrammed decision, but behind the scenes he has really made the decision on a programmed basis by using a “partial precedent” (incomplete as a whole but applicable in part) as a guide.

Drucker pointed out that programmed decisions usually have only one right answer, because the problem being addressed involves restoring or maintaining the status quo - - - the operation at its present level. We understand such decisions - - - the programmed ones - - - the routines, pre-set and “by the book” - - - precisely *because they are not decisions after the first time*.

The first time these turned up they were unprogrammed, and they therefore required a decision, or a set of decisions, to cover the immediate situation. If that decision were proved to be correct, then recorded, when the problem was first experienced, on all those future occasions no decision would be necessary because some standard, precedent, rule, regulation, law, or “standard operating procedure” (quite commonly called “S.O.P.”) takes over. So this class of unprogrammed decisions can become the programmed type which attends to a standardised situation.

However, there still remains a group of first-time, not-previously-experienced, answers-as-yet-unknown, and unique unprogrammed decisions which managers face from time to time.

Then there is the group of *really* unprogrammed decisions. Because these are “first time” decisions there will be an unknown and unquantifiable risk that the action decided will be wrong. All we can know about these “first time” decisions is there’s an infinite number of ways to be wrong, and a limited set of right answers (often, or usually, only one?).

Drucker then subdivided this “first time” group into two classes:

- (a) Those involving optimising, choosing the “best” or optimal answer. Here logical, rational, analysis succeeds. These respond to “management science”, and are generally not business survival-or-death decisions because there is usually a range of acceptable answers, all close to “best”.
- (b) Entrepreneurial decisions, with not only no right answer but also usually no optimal answer, with a tendency towards high, or even full, uncertainty.

Those in (b) are a different type of decision from those in (a). The (b) type are likely to cause a major impact on the manager making them as well as on the organisation for which they are made.

Drucker’s point about type (b) is that the aim in such a case cannot be to eliminate or reduce risk caused by uncertainty, or even to minimise risk, but to make the enterprise capable of taking bigger risks - - - but the right ones.

(As is often the case with Drucker’s writing, this is an interesting and refreshing way of looking at decisions and risk.)

THE IDEA OF DECISION-RATIONALITY

Now for some ideas of how decisions are made, and there’s a general assumption that the process is rational (Harrison, 1987). The idea of rational thinking goes back a long way, even to the ancient Greek philosophers. The father of the more modern developments of this appears to be Descartes, probably better known among engineers for his work on co-ordinate geometry. His proposition on rationality was that if we start with one basic premise it is possible to go step by step from that to an appropriate conclusion, with every step verifiable and repeatable under the same conditions. If someone else were to repeat the same process from the same premise, he’d get the same result.

So this is the idea behind rationality in decision-making, that if we start from the same premise, then each step in the reasoning can be followed and understood by another person operating via the same logical processes. A truly “rational”, or logical, decision would therefore be one based on purely objective information and reasoning, on hard facts on the one hand and two-plus-two-equals-four reasoning on the other.

This is, of course, the sort of decision-making which originates from computer-analysis of problems, and it’s absolutely faultless as far as it goes.

It’s not the same as the situation involving two fishwives who were seen arguing abusively across a narrow street in Aberdeen, in Scotland.

Two academics were passing by, and one said to the other: “They’ll never agree. They’re arguing from different premises.”

For another to try to suggest whether a decision was rational or non-rational can be extremely difficult. One person’s believed totally rational and logical behaviour may be another person’s perception of total, certifiable, insanity. Also, there’s a fine distinction between the

blundering idiot who follows protocol but leaves the swamp overflowing and the smart guy who won't follow protocol but applies initiative to drain the swamp while dodging the alligators.

Thinking further about rationality, it is obvious that unless full objective information is available then the necessary conclusion to satisfy the pre-determined objectives will probably not be stated, and the nominated end-point will not necessarily be reached. Also, the result can be, and often is, quite wrong, and the obvious reason for that wrong result is full and objective information is really never available.

However, even if full objective information were available, the "best" result may not be reached. The reason for that is simply that a totally rational approach would have to omit the subjective, gut-feeling, items of information, which would of necessity be unsupported by any of the objective evidence demanded by the rational process. Very often the gut-feeling information, which contains the emotional and inexpressible data, can be important.

The terms "objective" and "subjective" have been used above to identify the difference between a decision based on external, quantitative, "hard", information, as opposed to one based on internal, personal gut-feelings and beliefs, all "soft" evidence, quite unquantifiable but of which one must nevertheless take notice. Many writers (for example, Massie (1971), as well as many other, later, writers) have referred to these and have distinguished between them.

Referring further to the matter of the two sorts of information, there is no conceivable reason, in this author's opinion, why one "sort" of information "must" or "should" be more accurate than the other at all times, but of course many, especially engineers and accountants, prefer objective to subjective evidence, or information. Indeed, many people will ignore subjective assessments of a situation and refuse to recognise that such a condition exists. But it does.

Who remembers Harrison Ford, as Han Solo in "Star Wars", saying repeatedly: "*I've got a bad feeling about this!*"

He was right every time, too. Does that suggest anything about his ability to assess probability? Or were the situations stochastic, for some reason?

Nevertheless, it's often right for those people at least to attempt to suppress the internal (to a large extent conditioned-by-training) desire for firm, objective data, and to work on feelings, to some extent. Peter Drucker criticised this innate desire, gently but somewhat sardonically, in the movie **The Effective Executive** by stating what he called the only thoroughly proved law of statistics: "Tell me what facts you want and I'll tell you where to find them."

Equally, one may be sure other decisions would be improved if those who "normally" make them on emotions-bases were able to employ some objective, rational, techniques.

It becomes evident that programmed decisions, dealt with correctly by use of established routine, will have a high probability of success because they have been tested in previous applications, hence they have a small risk of the desired result not eventuating.

But unprogrammed decisions, whether they be of the optimising or entrepreneurial type, lack established routines developed from precedent, and will therefore have a lower probability of the "best" answer being chosen, and of satisfying. They therefore hold more risk of failing to satisfy, of *not* satisfying.

SO WHY IS MANAGEMENT HAZARDOUS?

It's tempting to argue from the above that decision-making is a smooth application of education and training. Well, education and training probably helps, but that's not the whole story behind successful decision-making.

Management is unreliable, hence a hazard to those who work as managers, to those who work under them, and to the firms employing them, because managers must make decisions, often unprogrammed, and managers can, and will, make mistakes when making decisions, particularly those unprogrammed. A manager's mistake can ruin his career, can injure or even kill a subordinate, and can send a company into liquidation.

Having made that statement, that managers are unreliable because they make mistakes, this author is bound to offer, first, proof of the proposition, and second, some analysis of why managers make mistakes.

Here's an illustration. In Australia we have recently been through an insurance crisis, with one major firm going into liquidation after buying out other firms, paying consultants, and rewarding executives, spending relatively enormous sums on all three. The chief executive has been in court, has been questioned about what happened, why did they do what they did, and the answer seems to be: "It seemed to be a good idea at the time." What seems to be coming out, dragged out by counsel's questions, is that the senior management made some very serious mistakes. The usual excuse for making mistakes is that the person was only human, rather than divine, but in our insurance debacle it appears the human quality greed has been involved as well as a sheer blunder.

And another, older, and relevant to this Conference. Engineers and managers in the process industries in your isles will remember the incident at Flixborough was caused by management not controlling a plant modification, by omitting a checking-action, and thus allowing the work to proceed without full investigation. We had our equivalent, a few years ago, at Longford, also traceable to management.

The making of a particular type of management mistake was explored by giving senior students in mechanical engineering, most of whom were already in supervising positions in industry, a series of management cases, each case containing three 'levels' of decision-making problem.

The first was a technical-engineering problem, of relatively trivial value in the general context.

The second level was an 'obvious', 'local' management problem, which the students are required to solve, or at least resolve, as it related to the week's lecture topic.

The third level was some other management-related feature of the factory (such as the conflict occurring between two characters), or of the company as a whole (for example, the entrenched hierarchical structure and its politics).

In addition there was a background problem, indicated by an accident which happened every week, but not mentioned in the terms of the assignment.

The mistake-causing elements were identified as follows:

strangeness - the cases were set in the chemical industry, in a continuous process system, 'strange' to most of the students,

uncertainty - the students did not know what to expect would happen next week (although the author, obviously, did know),

precise tasks - there was a clearly indicated problem (the 'second level' management problem),

immediacy - the assignments were on a one-week cycle, to be returned one week after being handed out (mirroring real-world urgency),

time pressure - the immediacy was increased by the presence, hence pressure, of work in other subjects.

The "mistake" which a large number of students committed was classified as the "error of omission" (Ward, 1993). All solved the engineering problem, most answered the local management problem, many at least commented on the company problem (some with disgust), but only a very small number, two out of thirty, took any notice of the continuing accident-events - - - which ultimately led to a fatality.

WHY DID THE STUDENTS MAKE THAT MISTAKE?

The majority fell into error because they concentrated on what was directly before them, the section of the subject impressed on them by the week's lecture, and they ignored the accidents which were going on because that was the unprogrammed part.

Fortunately, most management decisions are programmed, they have been worked out in the past and can be found in policies and procedures (S.O.P.'s), what the lawyers call precedents. It's just as well there's a lot like that, because without all that awful documentation a lot of decision-making couldn't be delegated.

But managers do meet unprogrammed decisions and a manager must act with imperfect and incomplete knowledge of what's behind the need to decide, and without a methodology to deal with them. As already noted, the way comes from what we call "experience", an experienced manager can "cheat" by applying his knowledge of what worked in a similar situation last month, or last year, and make adjustments to suit a situation which may be similar, but not quite the same as, the one now being faced. That works in some cases, but not when the situation is something quite novel.

When a truly novel, unprogrammed, decision arises the opportunity for serious error increases because the manager must use judgement. That is the true background reason for the students' error. They were left (deliberately) to their own devices to choose what parts of the assignments they would answer, and the majority judgement was faulty.

So now for a look at a quality which is even more mysterious than simple decision-making (which is mysterious enough): judgement.

JUDGEMENT

Some decisions cannot be made entirely by use of objective techniques, and require use of the mysterious element we term "judgement". Here, this is not what is pronounced in a court of law by a judge, based on evidence presented by lawyers and witnesses, some expert and some lay, the balance of probabilities, beyond all possible shadow of doubt, it's what a

manager uses when facing a truly unprogrammed decision. He uses a “judgement technique” which may, or may not, appear to be rational to others.

The type of decision-making in which an individual’s judgement is required has been given the title “judgement call”, a phrase originally, I believe, from the USA military, but the term has by now been taken up by business (Mowen, 1993). Expressing the need for such a type of decision is often indicated by another person saying to the decision-maker: “It’s your call.”

How may we define a judgement-call-decision?

It is a choice, in a high stakes environment, between two or more poorly-identified options, and the choice must be based on ambiguous information while facing conflicting goals, often with a close time-horizon.

What are the characteristics or parameters of judgement calls?

First, here are some typical situations, which identify decision elements to be weighed up (Mowen, 1993):

1. To shoot or not to shoot (clearly a military example), or to go ahead or to not go ahead.
2. To stay or to quit.
3. To retain present security or to seek future possible gain.
4. To accept risk or to retain security (related to 3. above).
5. To indulge in chance or to maintain control (combining 3. and 4. above).

Re the fourth above: bear in mind that risk is expressed pseudo-mathematically as the product of consequences (damage or injuries caused by an undesirable event following a decision) and the probability or uncertainty (of the event occurring). Some low-probability (very unlikely to occur) events have serious consequences (and may occur, though improbable).

How may we find help in deciding how to answer a judgement call? By using these understanding elements which will assist decision action:

1. Find the cause of the problem (which may be difficult if time is short).
2. Choose a frame of reference (how does the cause relate to the situation?).
3. Use reason rather than emotion (but recognise feelings may be helpful).

We should now review the steps which should help in any decision-making situation:

1. Be sure of the desired goals or objectives.
2. Observe a need, or a deficiency, in the path towards those goals or objectives.
3. Question: does that present a problem?
4. If so, identify and express the problem clearly.
5. Generate options to solve the problem.
6. Assess and evaluate the options.
7. Choose an option (strategy) and decide what to do (tactics).
8. Implement and act.
9. Monitor progress and results.

Now we can see why a judgement call decision can be difficult! It’s because in an unprogrammed decision, a judgement situation, Steps 1 to 6 involve uncertain, possibly

conflicting, goals, lack of accurate information, and time constraints, with a background awareness that getting it wrong may have serious consequences!

The one serious consequence from this decision situation is an intermediate condition, prior to the ultimate consequence; it's what happens as soon as the Cooper's "commitment to action" occurs, it's the decision-maker reaches "the point of no return" (Dearlove, 1998). It's like stepping on a banana skin, or a patch of oil, on the pavement, once the step has been taken opportunities for recovery are severely limited and most often do not exist.

And *that* is why a judgement-call-decision needs to be a correctly-made decision. There is, almost always, no second chance, to allow going over and correcting what was done. It's rare that we can hit the rewind button of life and rerun the event to correct whatever went wrong. The rare occasions when that's possible are the result of sheer luck, another mystery-management quality.

Nevertheless, many managers make judgement-call-decisions successfully. How? By practice? By "cheating", falling back on perhaps-ill-remembered incidents from the individual's past? Or, like judges in court, by precedent, from previous cases provided by others? Or is it by some negative-selection reason, because those who are successful are the managers who do not avoid making such decisions?

There's scope for research in this, particularly in the hazardous industries.

AN EXAMPLE OF APPLICATION OF JUDGEMENT

This example is not from industry but from ordinary everyday life, which in this author's opinion makes it more telling - - - certainly for this author - - - and it shows what can happen even with the best of intentions and appropriate knowledge of the situation.

In January this year a group of people had been attending a seminar on one of the Hawaiian islands. After it concluded they set out to celebrate, going to a property owned by one of those attending, and came to a ford across a stream. The property was on the other side, and the owner of the property, who was driving one vehicle, had crossed this ford many times, so he took one group across in his four-wheel drive, then went back for a second group, two in the front seat with him and two in the back seat.

Halfway across the ford the flow across the ford increased very suddenly to a wall of water. The vehicle rolled over and was swept downstream. The two in the rear seat escaped with injuries, the three in the front seat were killed by impact against rocks and by drowning.

We can review how the driver decided to make the second crossing. It was based on experience of having driven across the ford many times to his property, plus looking at the water flow, the general weather conditions, and of course on having made one successful crossing immediately before. His judgement was that another crossing would be safe.

That incident has, through this year, impressed this author with the fallibility of judgement. It's often all we have when making decisions, but it can lead to tragic consequences. In this case one consequence was the loss of my forty-year-old daughter, who was one of the three in the front seat.

CONCLUSION

The conclusion which comes out of the above musing on the hazard every manager faces when making a decision is that there's no way out of the bind managers face.

If the decision's programmed it's a low hazard with low risk, with high probability of being "right", with small consequences if "wrong" for some unexpected reason. But managers are paid to meet unprogrammed decisions, sometimes highly hazardous, with high risk, with potentially serious consequences, and usually with an unknown probability of result.

When the decision is sufficiently highly unprogrammed there are no rational ways to find the right answer. So judgement is needed. Only time can tell whether that produces a satisfactory result. After all, what is the test to be applied to a decision, so we may say whether it was successful? The only test is to look at the result. A good result *suggests* the decision was correct.

Unfortunately, although there are ways of teaching objective, rational, decision-making, there seems to be no way to teach managers how to use judgement. And, equally unfortunately, judgement is often needed in making decisions.

The result which inevitably stems from that analysis (as well as from some historic examples) is that management *per se* is an inherent hazard within a business enterprise. For as long as we have enterprises we need managers. If we could eliminate managers we would remove a major hazard in the system. But having "a manager" has become an essential part of the system, and we cannot imagine an enterprise functioning without management.

The ultimate irony of this circular problem is as well as dealing with all the other hazards in a business (financial, physical, etc) management should recognise and deal with the hazard itself presents.

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