

The Exception that proves the rule: A case study in successful British innovation

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It is widely acknowledged that whilst the UK is amazing at coming up with new ideas, it is far less successful at turning those ideas into commercial success. There are, however, a few striking exceptions. By examining these exceptions we can shed light on why they are not the norm. In the 1980's, whilst working for the then Plessey Research (Caswell), I was an integral part of the team that did have one of those rare innovative success stories: the 'cradle to grave' research, development and manufacture of the silicon chips that were an essential part of System X: the UK's pioneering digital telephone exchange system.

Not only was System X a world leader, setting the standard for the digital telephony that underlies the whole Digital Age in which we live, but many of those System X exchanges installed in the 1980's are still working today, over 30 years on. Their design life was 20 years. I know because as project quality engineer it was my job to ensure it. By any criterion, System X was a British innovation success. Why? How?

In this article I reflect back on my days working on the project and identify some of the factors which were very much in evidence then, but seem sadly lacking in many organisations and projects today.

Background

At the time of the System X project, Plessey Research Caswell was a world renown centre for excellence in microelectronic research and development (R&D). It was an integral part of the then Plessey Company, developing microelectronic components that would be incorporated into systems made by other parts of the company. The silicon chips developed there would go into production at a Plessey Semiconductor plant (in Swindon or Plympton). Customers of the Plessey Company included the UK MoD (Ministry of Defence), ESA (European Space Agency) and, as for System X, The Post Office (which became BT, British Telecom). The reputation of Plessey, as a whole, and of Caswell in particular, covered not just technical originality and innovation, but the highest quality and reliability of components & systems and dependability of the organisation.

Caswell itself occupied a remote site in the fields of South Northamptonshire, UK. The research labs were moved there by Plessey during the Second World War to reduce the likelihood of enemy attack disrupting its vital war work. In the 1980s it employed around 500-600 scientists and engineers from a broad spectrum of disciplines from CAD (Computer Aided Design) to theoretical physicists specialising in semiconductor devices.

Culture and atmosphere

It is hard to separate out the history and reputation of Plessey Caswell from its culture, atmosphere and working environment. The energy of creative thought & intense constructive activity was palpable. Whilst experts in each technology area or role might work with their immediate contemporaries, it was a multi-disciplinary environment with an 'in this together' mentality. It had an excellent on-site canteen, Sports and Social Club

and other initiatives encouraging and enabling staff of all levels and functions to interact outside of their project work as well as within their teams.

Because most projects undertaken were cutting-edge there was a real sense of the new; an almost childlike sense of excitement and wonder as previously unthinkable designs or products evolved from creative spark to demonstrable concept to small scale production.

In Plessey days the senior management (in particular Dr J.C. Bass) understood the needs of a good researcher: freedom to explore new ideas, to be supported without undue pressure. They knew that creativity cannot be forced, it has to be allowed to emerge.

A 'can-do' attitude was prevalent across all departments, not just the newsworthy technical areas, but the support services: from the workshops that made jigs and the team who ran the SEM (Scanning Electron Microscope) and other state-of-the-art analytical equipment to the contracts officers and newest trainee.

Underlying all of these ways of thinking and working was an across the board attitude of mutual respect and worth. Special efforts were appreciated and rewarded . . . rather than expected and taken for granted as seems so commonplace today. A particular example comes to mind:

System X has reached the stage where Caswell had to produce the first significant number of IC (integrated circuits). Timescales were tight and this was state-of-the-art technology. Nothing like this had been attempted before yet these ICs were destined for the first System X telephone exchanges and expected to last 20 years, switching phone calls for millions of subscribers every day. Inevitably there was challenges. But everybody, from executives down to technician, pulled together and we made the delivery. Shortly afterwards the Marketing Manager (Dr Steve Hollock) arranged a thank-you buffet for everyone who had been involved. He genuinely appreciated the efforts made.

Strict but flexible Quality Assurance

Plessey Caswell was approved to a number of national and international Quality Management Systems, including ISO9001. At the time of System X these began to require Design Reviews. This simple idea became a powerful technique in ensuring that a given product design (for example for a particular silicon chip) took into account, from early days, the eventual need to become mass produced. Based on the basic QA principle of 'right first time' it brought together representatives from Design, Production, QA, Marketing (for example) and enabled a shared understanding of the project needs.

It was such QA and management approaches, which in System X days were themselves innovative techniques, that contributed significantly to the success of the System X chips. By asking searching questions at the beginning of the design process, the design team came to anticipate potential problems and design them out, rather than assume that everything would be OK. Today a similar approach is often called 'risk-based' and is applied to service industries as well as to product.

But although these management techniques provide much assurance of eventual, long-term success, they are only as good as the actual review meetings held during any given project. And that, in turn, depends upon the attitude of all involved. For System X, the customer (BT) were excellent at asking searching questions and we, in Plessey, took

seriously the task of finding answers. This was not just a box-ticking exercise, all involved cared about the company's reputation, to the extent that it reflected our own sense of worth.

This was a project that really mattered. Maybe that is another underlying factor here: this project was a 'first-off', it would set the companies concerned, and the UK, ahead of the field: and a whole new branch of technology began in a way we did not imagine at the time. Likewise, in other projects where lives could, literally be at stake, attention was focussed. This was not just a milestone to be met, profits to be made: we could imagine, if not hear from real people who would be seriously affected if what we were doing went wrong. There was a felt connection between what each of the team was doing and the overall project's intent, between team members and end-users: who may be one and the same. How often is that the case today? How can products or services that are the latest 'must have' really matter enough for the workforce to care about them?

Cradle to Grave

Whilst the semiconductor technology of the 1980's was fast moving, it had not reached the rapidly moving scene of day. A printer was still a serious piece of capital equipment, not the disposal item it usually is today, for example. With a 20 year design life, BT required a system and thus components that would last that long in service. And if they didn't, parts that might fail should be quickly and easily replaced. The cost being considered was Cradle to Grave, or Life Cycle Costing (LCC); another new concept in these days.

Maybe because Design Reviews and LCC were new ideas, they were taken seriously. Default processes had not been developed, ways of thinking had not become set in stone. The air of open questioning prevailed: we were all keen to make all this new technology and new management approaches work, so entered into the tasks with keenness and enthusiasm. There was a willingness to admit when we didn't know, to ask others and to listen to alternative perspectives. Again, the underlying ethos of 'in this together' helped ensure that all eventualities were considered and appropriate corrective actions taken when required. Little of this occurs when even a proportion of the team are merely 'going through the motions', as seems, frequently, to be the case today.

Discussion

Few of the specific ideas mentioned above would seem particularly relevant to innovation, in the sense of turning a one-off pilot into a commercial success. However the integration of Caswell into the Plessey Company and the close working relationships between Research and Production teams, enabled and supported by Design Review and related Quality Management, would have been important factors.

Similar 'can-do attitude', 'customer care' and 'pulling together as a team' philosophies are accepted facets of a successful organisations today, yet the reality often seems to fall short of the intent, and of the experience of System X. Why is this?

A few commentators will now recognise a key underlying factor: culture. A genuine, inner, passion to work together for the greater good, to share honestly and openly. Where does this come from? How can it be fostered?

In Caswell's case it was the result of decades of dedication and commitment. Some may accuse me of looking back with rosy-tinted glasses, to which my response would be this:

I have since worked on other projects in a range of environments, and would conclude that those that have been really successful (for example the [Experience of Worship](#) research project) have been those with a similar culture to that at Plessey Caswell: a shared a deep connection to something beyond meeting a milestone.

Failure to acknowledge and embrace the passion, the deep feeling of connection within an 'in this together' organisation or team is, I would argue, a major reason why some teams fail. As human beings don't we all need to feel we belong? And need to feel valued? Whether engineer or manager, technician or director, each has a deep and inner need that goes beyond team-building strategy or improvement campaign.

Plessey Caswell had heart and soul. It was not to last. By the time GEC-Marconi had taken it over (as part of hostile take-over of The Plessey Co. by GEC-Siemens in 1989), that heart and soul was gone. The world renown activity did not last many more years.

Global Significance

As Britain seeks to work more closely with China and/or Japan (for example on Wylfa Newydd in North Wales), these cultural differences take on an added significance. In Asia, a truly long-term view is the norm: hundreds rather than tens of year. In Asian culture, trust comes first. Talk to staff of companies that have managed to succeed in China and you will hear stories of the British and Chinese going out socially, and maybe getting drunk together, before signing any agreements. Isn't this part of building a similar level of trust and an 'in this together' relationship as seen in System X?

I'm reminded of examples of the difference in culture between Plessey and GEC-Marconi:

In Plessey days, business trips to Europe would involve a Club flight over the day before and an evening meal with our hosts. It was during these social events that teams, and individuals, would get to know each other: really get to know each other. It was through the social programme around a meeting that trust would be built, cultural differences embraced and lasting personal relationships forged. How can any meaningful collaboration be successful without such inter-actions?

These periods are essential precisely because they are not part of achieving some planned milestone. Such inter-personal development, and the soft-skills required to make them successful, are vital parts of any meaningful ventures **because** they are concerned with feelings rather than facts.

In Plessey days, Caswell employees who **didn't** enjoy their job were the exception. In GEC-Marconi times, it seemed to be official policy that staff should **not** enjoy their work! Yet how can we expect the best from someone who is not happy in their job?

Such issues may seem divorced from and insignificant compared to the practical issues involved in turning one-off achievements into large-scale successes, but I would argue to the contrary:

A lone engineer, working without the constraints often inherent in formally constituted teams, has the freedom and flexibility to try the unusual, explore the unknown. In an organisation governed by rigid structure and procedures, it is less likely they would be able to achieve their breakthrough in originality or innovation. Within a more flexible, trusting, workplace, however, they would receive the necessary support and respect to dare to try something new.

Similarly, once the idea had been shown to be workable, he or she would feel far more willing and able to assist in the transition to production status. Also, with a genuine long-term, integrated work-force approach, prototype and production teams would have sufficient personnel and techniques in common for the transition to not be so extreme; and thus more bridgeable.

Implications to training for Innovation

How can the experiences highlighted by this case study be applied to the teaching and training of engineers, managers and others seeking succeed in innovation, in any field?

The lesson is clear: a commitment needs to be made to a genuine 'heart and soul' approach to running projects and businesses. There needs to be a clear acknowledgement that staff and other stakeholders are thinking, feelings, human beings. Likewise subjective aspects of the working environment, product design, manufacturing process etc. require equal attention to objective factors; with the two facets being integrated in a natural, flowing way.

Above all, leadership and training needs to impart and demonstrate the soft-skill qualities inherent in this approach. 'Soft' is not, as often perceived, a weakness, rather an indicator of deeper awareness and flexibility, both of which are essential in a truly innovative working environment. It is no coincidence that, as this point, Chinese partners might quote the *Tao Te Ching*:

Soft and weak overcome stiff and strong

(Lao-Tzu, ca. 3rd Century BCE; Addiss, S., Lombardo, S., tr. 1993 §36)

The strongest armies do not conquer,

The greatest trees are cut down.

The strong and great sink down.

The soft and weak rise up.

(Lao-Tzu, ca. 3rd Century BCE; Addiss, S., Lombardo, S., tr. 1993 §76)

This article represents a development of the author's [work from his Plessey days](#), integrating the key finding of his more recent [PhD](#). He can be contacted [via his website](#).