APROS 13 Monterrey, Mexico, December 2009

Stream 4: Strategy and Change: Living with Maps, Masks and Mirrors!

CERN THROUGH THE LOOKING GLASS: NARRATIVE, META-NARRATIVE AND STRATEGY IN A TWENTY-FIRST CENTURY ORGANISATION

Stephen Little
The Open University Business School,
Open University,
Walton Hall, Milton Keynes,
MK7 6AA **UK**

Telephone: 01908-652862

Email: s.e.little@open.ac.uk

Abstract

This paper sets out the context for a two year study of relationships within the ATLAS experiment at CERN, Geneva, and focuses on the tensions between the narratives deployed by the managers within this international collaboration to enlist and shape the participation of its members. It describes the complex and potentially conflicting narratives deployed by the individuals charged with the management of a unique organization. These managers are scientists elected to their post by their peers in order to sustain the organization in conditions of uncertainty and complexity derived from the heterogeneity of members and stakeholders and the uncertainty inherent in the core scientific endeavour. These narratives appear to play a key role in sustaining the collectivist ethos which underpins the collaboration and which substitutes for formal managerial structures (see Knorr-Cetina, 1999). However this collectivism is itself an obstacle to effective performance in certain contexts. For example, technology transfer represents significant additional value from the core research at CERN. However the ethos of transparency conflicts with the commercial confidentiality essential to the marketability of intellectual property.

Keywords

Organizational narrative, scientific communities, technology transfer

The MODE research collaboration is an international interdisciplinary team of researchers from universities and business schools in Birmingham, Copenhagen, Dublin, Lyon, Bergen and the Open University in the UK. The Resources Coordinator for the ATLAS project at CERN, the European Organisation for Nuclear Research, is an active partner. The collaboration is investigating the processes of knowledge creation and dissemination within a network of some 2,900 researchers who constitute one of four major experiments at CERN. The present author is examining the mechanisms by which successful technological innovations are transferred from CERN to member organisations and other stakeholders.

In addition to the identification and formal protection of intellectual property created by the members of CERN, value is created through the collaboration between CERN members and technology providers in the form of intellectual capital and increased capacity generated through the development of the infrastructure supporting ATLAS and other experiments.

The technology transfer sub-project draws on existing research into technology transfer, intellectual capital and capacity building strategies to identify and evaluate the key processes which support this aspect of CERN collaboration.

Context and Background

Technology transfer is an important component of the argument for funding research which is investigating fundamental question of the nature of the universe, with little prospect of short term economic benefit. The technologies developed for the infrastructure and instrumentation at CERN represent significant innovations in a number of fields including detection and monitoring which have been transferred to medical and safety applications. The data processing requirements of the experiments has led to strong support from CERN for the development of grid computing. The most significant transfer of technology so far, however, has been the world wide web protocols developed to facilitate communication between the distributed members of the large experimental collaborations. In 2009 CERN staged a high profile celebration of the twentieth anniversary of the internal memorandum written by Sir Tim Berners-Lee which proposed this initiative[1]

CERN dates from an international council established in 1952 by eleven European states. The organisation was inaugurated in 1954. Following on from the creation of the

European Iron and Steel community the precursor of the EEC and EU, it represented a significant international collaboration in the context of a recovering post-war Europe. As a counter to the Americanization of nuclear physics via the Manhattan project it sought both peaceful research and the means to retain scientific capability within Europe. The established criterion of scientific success is the award of the Nobel prize. It was not until 1984 that the Nobel Prize in physics was awarded to CERN scientists. Carlo Rubbia and Simon van der Meer were awarded their prize for the developments that led to the discoveries of the W and Z bosons. Taubes (1986) gives a detailed account of the pathway to this breakthrough and Knorr-Cetina (1999) provides a comparison between knowledge creation in particle physics and molecular biology, drawing on subsequent work at CERN.

The 1992 Nobel Prize in physics was awarded to a CERN researcher, Georges Charpak for work on particle detectors. However, the scale and nature of collaboration at CERN makes the award of a prize which is limited to a maximum of three recipients highly problematic. CERN practice is to credit all members of an experimental collaboration as authors on all CERN publications. With teams numbering thousands, however, this practice is becoming increasingly unwieldy and is the subject of current discussion and re-evaluation.

A key issue for technology transfer is how the conflict between the open and collectivist ethos of the CERN community with the bounded and controlled requirements of intellectual property creation can be managed. Data is processed and distributed from the caverns at Meyrin to the participating institutions within hours of its creation and the discussions at the ATLAS week were both open and critical of past decisions. Technology transfer features in the wider narratives of CERN's scientific and social contribution and these provide an insight into the internal perception of this feature of the organisation's activities.

Since its inception the membership of CERN has expanded from 12 to 20 core members. Six states plus the EU and UNESCO have observer status and a further 35 non-member states have entered into co-operation agreements. Decisions are made though votes by national representatives at Council level and by the partner institutions from these countries at project level, one institution one vote. ATLAS, one of four major experiments located in 100m deep caverns along the LHC's 27 km underground circuit, currently

involves 2,900 physicists, only 100 of whom are employed directly by CERN. A quarter of the total consists of research students who are crucial to the running of the experiment. Key decisions on the experiment are made through the votes of the 172 member institutions from 37 countries following open discussions at face-to-face and online meetings. This practice is common to all of the experiments.

The MODE team includes the Resource Coordinator for the ATLAS experiment and meets regularly at CERN. In July 2009 members attended an ATLAS Week. This was a programme of on-site meetings and technical seminars, streamed via the internet to the majority of members who could not be physically present. The plenary discussions focused on the recommisioning of the LHC after the completion of repairs and modifications following the September 2008 accident. This had taken place just ten days after the high profile commissioning event.

Following presentations on the status of both the collider and the ATLAS detector, the main issue of discussion was the energy level at which the machine should be operated versus the timing of "first collisions". A prominent factor in this debate was the requirement for live data to allow a significant number of doctoral students to complete their degrees. These meetings also marked the handover from the previous Spokesperson for the experiment, Peter Jenni, to his successor, chosen by a ballot of members, Fabiola Gianotti. The internal role is one of convener and the external that of a public face for the experiment. These and other posts are held for a limited period by active scientists so that there is effectively no managerial class at CERN. The tenor of the meeting typified the collaborative work practices of the ATLAS collaboration.

The main site at Meyrin outside Geneva now spans the Franco-Swiss border, though there is little evidence of this within the site and since 2008 Switzerland as part of the Schengen area has opened fully its land borders. The site itself reveals the history and origins of the organization and its established practices. Many of the older buildings reveal their origin in a straightened period of post war reconstruction. Only the most public spaces reveal a moderate level of aesthetic sensibility and only the most recent construction, including Building 40, the main centre for the LHC experiments, represents state of the art architectural practice. In the buildings used by the MODE group for meetings, the wear and tear of thirty years is evident, with worn (but safe) flooring, and only the IT infrastructure

reflecting current standards. The majority of participants in CERN experiments are based at their own institutions and visit the Meyrin site for days or months at a time. The on-site hostels are modern but functional with rules against noise at any time of day or night. The atmosphere is positively monastic.

The most prominent (and sinister looking) building on the site is the Globe. While it resembles a fast breeder reactor building it is in fact a public exhibition and meeting space constructed entirely of timber and re-located from the Expo.02 site at Neuchatel. The Globe is used for high profile presentations of progress and results and for outreach to the general public, from secondary school onwards. CERN is focused on the science and the dissemination of experimental data to its members and the wider scientific community and this is where resources are concentrated.

Narratives and Stakeholders

The purpose of the successive experiments at CERN is to get progressively closer to conditions at the moment of the creation of the universe. Close (2007) provides a (relatively) accessible account of the development of particle physics up to the current concerns with the Higgs boson. To achieve its goal, however, the organization has to maintain support from national governments, the member and partner institutions from within those countries, the scientific community and individual scientists and members of the general public.

The cancellation of the US super-collider project (SSC) in 1993 made CERN "the only game in town" and greatly aided its aim to become the world center for particle physics. However, it also highlighted the vulnerability of pure research to political priorities and pressures. SSC was abandoned following lobbying from competing scientists including solid state physicists arguing that a greater and more immediate economic impact would result from research into the physics of electronics and microprocessors. As a consequence a complex of internal and external narrative presentations has developed around the activities and priorities within CERN.

The role of story and narrative in organizations has been discussed extensively in the past decade and had become a key component of knowledge management Denning, 2000; Gabriel, 2000; Seely et al, 2005). To maintain cohesion and commitment among participants, and to sustain support from member countries, CERN deploys narratives of its

50 year history as a pioneering transnational institution alongside a parallel meta-narrative which runs 13.7 billion years into the past to the Big Bang.

The time-span from the inception of an experiment as a technical proposal to the delivery of data for analysis and argumentation is measured in decades and commonly exceeds that of an individual's career. The management baton must pass between incumbents who are committed to the role of "coordinator" for overlapping three year terms. The Higgs mechanism was theorized in 1964. The LEP (Large Electron-Positron collider), precursor to the LHC (Large Hadron Collider) was proposed in 1977 and construction of the 27 kilometer tunnel for it was approved in 1981. The concept of hadron collision was mooted in 1984 and the LHC commissioning date slipped from 2002 to 2008, with the first collisions, at energy levels which are expected to create Higgs bosons, likely to take place in late 2010 at the earliest[2]. Low energy collisions were achieved on 6th December with the expectation that experimental data would be obtained from collisions at 3.5TeV during 2010. This will be the first new data since the decommissioning of LEP in 2001, in order to reuse the tunnel for the LHC.

Once the novel equipment has been designed, constructed and commissioned, the management of CERN experiments involves decisions on upgrades, negotiation over priorities and access to the beams delivered by the collider. The extended project time-frames require the continuing motivation and recruitment of participants and there is evidence that the complex career trajectories of individual participants are and sustained by organisational narratives. For example, the manager responsible for the day-to-day running of the ATLAS detector, a physicist who has spent the last decade on a major construction project feels "closer to the physics" running the detector because useable data is about to be produced.

More recently CERN's narratives have been extended to address the general public, giving the Spokesperson for each experiment a higher public profile. However, the publicity surrounding the initial operation of the LHC in autumn 2008 led to court cases seeking to shut down the experiments lest they create a black hole capable of consuming the entire planet (Gray, 2008). The failure of the collider beam on 19th September 2008 after ten days of operation gave the widespread external impression of a major problem, very different from the perception within the organization, signalling a new layer of

complexity in the environment of CERN. The combination of popular speculation and the policy of outreach through popular media has led to some problematic effects. While the profile of particle physics has been raised, the expectations of the general public are some distance from the reality of the work in hand. Collaboration with production of the film of Dan Brown's "Angels and Demons" has allowed a companion web-site to draw interested individuals in to the reality of anti-matter production and way from Brown's fictional antimatter "bomb"[3]. However, a BBC radio drama broadcast on the eve of the initial LHC operation in September 2008 implied that results would be instant. Instead the initial operation of the new detectors will be concerned with replicating the results obtained with the previous generation of technology, to demonstrate their compatibility and accuracy, before moving on to the search for new phenomena. Such conflicting expectation of the time-frames of technical and scientific progress is potentially damaging to a project (Little, 1987).

Speculation on the nature of the delays in decommissioning the LHC reach a nadir with the argument aired in the British Sunday Times newspaper on 18th October 2009 (Leake, 2009). This was based on speculation that the LHC was sabotaging itself from the future on the grounds that the Higgs boson is "abhorrent to nature".

National Narratives and Absorptive Capacities

The complex multinational composition of the research teams means that the narratives generated around CERN's goals must interact with a variety of national narratives of history and progress. These vary significantly and have an impact on national absorptive capacity (Cohen and Levinthal, 1990). For example, Japan's rapid absorption of foreign innovations, following the Meiji restoration reveals a different relationship between heritage and progress than in western cultures. Japan's absorptive capacities are linked to national narratives exemplified by the Ise shrine site. The temple to the sun goddess Amaterasu has been re-built regularly since its establishment in the 7th century. The key building is dismantled and replaced every twenty years with the same skills and techniques used for centuries, alternating between two adjacent sites. This very different understanding of authenticity allowed the retention of key aspects of the pre-existing culture and their use to mediate the transformation of society. Today Japan's major cities host an amalgam of futuristic and nostalgic technological references, Tokyo has its own version of the Eiffel

Tower while a 1950's vintage science fiction aesthetics is applied to tourist infrastructure and personal fashion.

National narratives can shift, however. In Russia a similar balance between heritage and innovation was maintained during the Soviet period, with specialist colleges established to train conservators for the reconstruction of Tsarist palaces while pre and post-war reconstruction continued into the 1970's with factory-built housing against a backdrop of modernist development in urban planning.

More recently, however, a less progressive form of nostalgia has appeared with the re-creation of the Cathedral of Christ the Saviour in Moscow. This building existed between 1881and 1933 when it was demolished to make way for a projected Palace of the Soviets. When this project was abandoned wit the onset of World War II, an outdoor swimming pool was constructed of the foundations. The cathedral was reconstructed in the 1990s to dominate Moscow skyline, but with a marginal claim to authenticity.

Britain's engagement with an industrial and scientific heritage is doubly problematic. There is a well recognized status problem for engineers in UK where there is a marked cultural preference for the "plucky amateur" personified by the cartoon creation of Wallace and Grommet (Frayling, 2008). In the preparation for the bicentenary celebration of the engineer Isambard Kingdom Brunel, one of the few widely recognized technical innovators, a debate arose over his representation on a two pound coin. It was proposed that a design based on an iconic nineteenth century photograph be modified to remove a prominent cigar. However, this unsuccessful attempt as sanitizing his image was less significant that the omission of his negative impact on shareholders and financiers from the official narrative.

In contrast, the Eden Project in Cornwall, England gives some hope that a better acknowledgement of both heritage and progress may emerge in the U.K. This project, funded from the national Lottery in a programme to create lasting legacy from the millennium celebrations is the most successful of its generation. While other environmental or cultural projects based in former industrial centers have failed, this ecological demonstration project built in an abandoned china clay quarry has flourished.

> "To get in shape for the challenges of the future we need a culture that knows how to sustain the things that sustain us and at the same time nurtures

creativity, imagination and adaptability"
(www.edenproject.com).

The context of natural heritage at the new millennium and the physical expression of the need for scientific understanding in order to conserve and protect natural legacy has achieved a popular response.

CERN: the limiting case for narrative construction

The power and efficacy of CERN's efforts to communicate its mission were demonstrated in May 2009 when an announcement was made by the Austrian minister of science that his country would terminate its membership of CERN as this was consuming too high a proportion of the national budget for international research. Within ten days, and following a global round of protests form the scientific community, the decision was reversed4.

CERN has deployed parallel narratives of a 50 year old transnational institution emphasizing its historical continuity with earlier revolutionary developments in physics alongside parallel meta-narrative leading backwards to the Big Bang although the limitations on this objective are less ell understood by the public. These narratives appear to play a key role in sustaining a collectivist ethos (see Knorr-Cetina (1999)

The short-lived 'withdrawal' of Austria from CERN membership in May 2009 demonstrates the power of the interwoven narratives for CERN. However, the very high profile of the LHC start-up produced expectations of "instant" results and resultant negative publicity. Worse, the policy of outreach through entertainment media can be problematic.

The Sunday Times newspaper proposal of divine intervention from the future (contrasts with the discussions at the ATLAS week which revealed a far more prosaic narrative involving calculated risks around simplification in construction. These resulted in damage to four kilometers of the collider circuit, and the comprehensive re-engineering of protection systems to prevent future damage.

Technology Transfer and Boundary Spanning

Technology transfer features in CERN's wider narratives of purpose and legitimation but further analysis is needed of the internal and external presentation of technology transfer, actual and prospective if the contribution is to measure up to the

parameters of 'open innovation' (Chesborough, 2003). Initial interviews have identified the conflict between CERN's collectivist and open ethos and the requirements for the successful formation and management of intellectual property.

Further interviews with the Intellectual Property team and with individuals within CERN who have entrepreneurial experience or aspirations around their knowledge and capabilities will take place in early 2010. An analysis of the geographic dispersion and How effectively are the external technical contributors brought into the CERN framework? How are such relationships managed in the face of the tendering requirements of CERN? Some contractors have achieved a lengthy relationship with CERN, but the requirement for contracts to be awarded to the lowest bidder results in the production of highly detailed specifications is problematic. It discourages larger integrated engineering companies from tendering. They judge that they will achieve little learning from following rigidly a pre-prepared specification. This is in marked contrast to relationships between the European Space Agency and aerospace contractors, where longer term and more integrated contributions are negotiated (Harvey, 2003). At CERN small and medium high technology companies are left to fill the gap, these in turn may win one bid, only to bid too high on a repeat tenders as a result of the lessons learn in their first contract. This leads to limited relationships with some tenderers. In the worst case, the contractor for the super conducting magnets for the ATLAS detector defaulted on their contract following a change in ownership of the company. The new owners quickly concluded that the contract was costing them money and opportunities and simply delivered the incomplete components to CERN who were then force to complete the work as their own contractor.

The interaction between internally and externally directed narratives will be an important aspect of understanding the dynamics of technology transfer from ATLAS and CERN, both through the spinout by members of the collaborations and through the recruitment of external stakeholders.

References:

Close F. (2007) *The New Cosmic Onion: quarks and the nature of the universe* Boca Raton FL: Taylor and Francis

Chesbrough, H. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston, MA: Harvard Business School Press.

Cohen, W. M. and Levinthal, D. A. (1990). 'Absorptive-capacity – a new perspective on learning and innovation'. Administrative Science Quarterly, 35, 128–52.

Denning, S. (2000) The Springboard: How Story-telling Ignites Action in Knowledge-Era Organizations, Oxford: Butterworth Heinemann

Gabriel Y. (2000) Storytelling in organizations: facts fictions and fantasies Oxford: Oxford Univeristy Press

Gray, R (2008) "Legal bid to stop CERN atom smasher from 'destroying the world" *Daily Telegraph* 09 Sep 2008

Frayling C.(2008) "From Brunel to Wallace and Grommet - the changing face of the British engineering designer" Design London STIR Lecture, Imperial College, London, December 2008.

Foray D. (2006) The Economics of Knowledge Cambridge MA: MIT Press

Harvey B. (2003) Europe's Space Programme: To Ariane and Beyond London: Springer-Praxis

Knorr-Cetina K, (1999) *Epistemic Cultures: How the Sciences Make Knowledge*, Cambridge MA: Harvard University Press

Leake J. (2009) "A particle God doesn't want us to discover" Sunday Times 18 October 2009, p.8

Little S.E. (1987) "The role of time-frames in design decision-making" Design Studies 8 (3) pp.170-182

Seely Brown J., Denning S., Groh K. and Prusak L. (2005) Storytelling in Organizations: Why storytelling is transforming 21st century organizations and management Burlington MA: Elsevier Butterworth-Heinemann

Taubes G. (1986) Nobel Dreams Power Deceit and the Ultimate Experiment Redmond: Tempus Books

Notes:

[1] Tim Berners-Lee celebrating 20 years of WWW at http://info.cern.ch/www20/

[2] Peter Jenni's presentation on the history of the Atlas experiment, Autumn 2008
http://www.cern.ch/jenni/Jenni.ATLAS.Start-up.rev.pdf

[3] See http://angelsanddemons.cern.ch/

[4] Austria to quit CERN particle physics laboratory
Fri, May 8 2009, 7:11 AM EDT
VIENNA (Reuters) - Austria plans to pull out of the international particle physics laboratory CERN because its share of the high cost is eating up too much of the country's budget for international research.
See the response to this statement at
http://user.web.cern.ch/user/news/2009/090508.html
http://www.math.columbia.edu/~woit/wordpress/?p=1978
http://www.teilchen.at:8080/teilchen/laufend/OneArticle?updatelogo=1;id=208;e=0
Austria to stay in particle physics lab after all
Mon, May 18 2009, 11:30 AM EDT
VIENNA (Reuters) - Austria has changed its mind and will now not pull out of the international particle physics laboratory CERN over the cost, Chancellor Werner Faymann said in a statement on Monday, overruling his science minister.