

**Graham Orange, Alan Burke and [Mike Cushman](#)**  
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**Conference paper**

**Original citation:**

Originally presented at BITWorld '99: business information technology management: the global imperative, 30 June – 2 July 1999, Cape Town, South Africa.

This version available at: <http://eprints.lse.ac.uk/24774/>

Available in LSE Research Online: August 2009

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## **An Approach to Support Reflection and Organisation Learning within the UK Construction Industry**

### **Graham Orange**

School of Information Management, Leeds Metropolitan University  
The Grange, Beckett Park  
Leeds LS6 3QS, England  
[g.orange@lmu.ac.uk](mailto:g.orange@lmu.ac.uk)  
Phone/fax: +44 113 283 3240

### **Alan Burke**

School of Information Management, Leeds Metropolitan University  
The Grange, Beckett Park  
Leeds LS6 3QS, England  
[a.burke@lmu.ac.uk](mailto:a.burke@lmu.ac.uk)  
Phone/fax: +44 113 283 3240

### **Mike Cushman**

Information Systems Department, London School of Economics  
Houghton Street, London WC2A 2AE  
[m.cushman@lse.ac.uk](mailto:m.cushman@lse.ac.uk)  
Phone: +44 171 955 7426  
Fax: +44 171 955 7385

More information on COLA may be found at <http://is.lse.ac.uk/b-hive>

### ***Introduction***

This paper describes the work of an EPSRC (Engineering and Physical Sciences Research Council) and DETR (Department for the Environment and the Regions) funded research project – B-Hive (Building a High Value Construction Environment). The research seeks to further develop partnering initiatives in the construction industry by creating processes and appropriate information systems support to assist with the task of more closely integrating the activities of companies which collaborate on construction projects. It is envisaged that these new processes will provide opportunities for reflection and learning and will create a more open, co-operative and less confrontational culture which will enable project participants to learn from both collective experience and the knowledge of individuals.

To achieve this objective, the research project addresses the problem of fragmentation in the industry. This issue is well documented (e.g. Latham 1994, Egan 1997) as being a critical barrier to change since it is seen as a major factor in the poor communications between parties working together on construction projects. This fragmentation means that the ownership and control of separate functions and their associated processes in the lifecycle of a construction project reside in the hands of separate organisations with their own distinctive cultures and working practices. Concomitant to this fragmentation at the level of ownership is the associated fragmentation at the level of project team membership which manifests itself in two

ways. Firstly, the transitive nature of team membership during the course of a particular construction project; 'teams' can be likened to the plasma in a retro-style table lamp with new members coalescing with an established 'team' and old members breaking off to join new groupings on different projects. Secondly, the fragmentation that exists between projects means that a 'team' is rarely left intact to build on their previous work together on subsequent projects. Such continuity is essential if learning benefits are to be realised (Barlow and Jashapara 1998). Further, the Egan Report points to the crucial importance of providing this kind of continuity in team composition:

“The repeated selection of new teams in our view inhibits learning, innovation and the development of skilled and experienced teams.”

(Egan 1997, Chapter 3, Paragraph 37)

and

“A team that does not stay together has no learning capability and no chance of making the incremental improvements that improve efficiency over the long term.”

(Egan 1997, Chapter 4, Paragraph 67)

Universal use of contracts as the primary means to regulate relationships and fragmentation at these various levels, has led to the ubiquitous acceptance that construction is a largely sequential process (Egan 1997, Chapter 3, Paragraphs 35 – 36) within which project development can be seen as a waterfall with information cascading down the system. This leaves little room for the utilisation of knowledge from other project participants further down the watercourse since few mechanisms exist for feeding back ideas to either improve the current project or to feed learning into future projects. Work by Salford University (Cooper) has sought to create a generic process model which includes provision for feedback and review at various stages in a project. Much further work is required to translate these good intentions into actions by developing the processes and changing the cultural practices which prevent meaningful reviews from happening on typical construction projects.

Pioneering partnership agreements which aim to integrate processes and bring cultural change offer an opportunity to change the *status quo* and bring about a paradigmatic shift in thinking, but much will depend on the strength of further initiatives if dream is to be transformed into reality. The meaning of partnership is still being explored and negotiated within the industry and agreements will need to be supported by a range of further initiatives if potential benefits are to be realised. This current research project represents one such initiative which aims to provide a process, with appropriate information systems and technology support, which can be used to promote organisational learning and informed action through a process of analysis and reflection at various stages throughout the construction process.

The project involves: two major construction clients, a privatised utility company (water treatment and supply and waste treatment ) and a major leisure services provider (hotel and country club group); a large construction company; two leading construction consultancy firms; and London School of Economics and Leeds Metropolitan University.

The project has concentrated on promoting and consolidating partnerships by designing and implementing a Cross Organisational Learning Approach (COLA) for the industry. Through a process of reflection and discussion COLA facilitates processes for review, learning, knowledge generation and dissemination, and is supported by information systems that both inform these processes and capture resultant learning.

### ***COLA: knowledge and organisational learning through reflection***

It is envisaged that COLA can play an important role in supporting these knowledge management activities.. The current topicality of these terms – “knowledge management” and “organisational learning” reflects the interest in developing information systems which go beyond merely storing information which is comparatively easily structured towards areas which cannot be readily analysed and modelled. Although it is not easy to draw a clear distinction between knowledge management and information management, use of the term often marks an awareness of a move into the ‘softer’ areas of the intellectual capital upon which enterprises depend.

However, some useful distinctions can be made between the two terms. Language constantly evolves and words shift in meaning; so, what does “knowledge” mean to this language community? Ackoff places knowledge in a hierarchy “stretching from data, through information and knowledge to the pinnacle of wisdom”. (Ackoff 1989). Perhaps it is useful to explore this hierarchy and to start by differentiating data from information. Checkland reviewed a range of literature and noted that definitions of data often include reference to “raw facts”, “raw materials” or “elements”. Whereas words like “shape”, “value”, “interpret” and “relevant” are used in defining information. He concludes that there “is a partial consensus that data is transformed into information when meaning is attributed to it” (Checkland 1998). Where does this place knowledge? On one level “information” can be used as a synonym for “knowledge” but it is argued that it justifies its elevated position in Ackoff’s hierarchy because it often carries a much greater weight of meaning.

This extra weight of meaning can be further explored by drawing upon a distinction philosophers often make between propositional knowledge and practical knowledge (Landesman 1970). Propositional knowledge is concerned with knowing the truth of a proposition – “these roof tiles are better than those because those suffer from exfoliation when exposed to frost” – whilst practical knowledge is concerned with how to do something – “I know how to manage this project” or “I can build a brick wall”. Such categorisation can be challenged since knowing how to do something may entail having propositional knowledge, but with some caution the distinction can still offer us some service. The concept of information seems to be close to what we understand for the concept of propositional knowledge.

Epistemology has centred on propositional knowledge and the problem establishing whether something is true or false (Hospers 1967). For the purposes of knowledge management far more attention needs to be given to the nature of practical knowledge and the social construction of knowledge. It can be argued that two significant

features which set this kind of knowledge apart from information are: the extent to which this knowledge is wrapped up with our own personal and collective identities and our sense of self worth; and, secondly, the fact that claims to practical knowledge are judged according to the intelligence shown in the performance of a task or activity. Information is a more neutral concept which does not carry this extra weight of meaning.

It is important to realise that believing knowledge, or at least certain categories of knowledge, to be socially constructed makes it a dynamic commodity which is not easily captured and structured. For example, knowing how to do something in an organisational setting is often a complex activity which requires not only knowledge of formal procedures but also of: informal procedures; individual and collective capabilities; organisational roles; expectations about behaviour; and the values which are used to judge performance in roles. This kind of knowledge is constantly being reappraised and refined as the organisation carries out its activities.

Such knowledge may be seen as either explicit or implicit. Explicit knowledge is that which is readily structured and codified and may be stored in a number of repositories - databases, spreadsheets, architects drawings, libraries - and imparted through the use of traditional learning methods (Snyder and Wilson, 1998). Knowledge that is readily codifiable is more easily captured, stored and disseminated than the 'softer' types of expertise which are embedded as tacit knowledge.

Tacit knowledge (also known as implicit knowledge) is that which is stored in peoples' heads and is often communicated informally and is often the most valuable to an organisation. It is personal, being based on an individual's perceptions, values and intuition and is a significant part of the knowledge which defines an individual as an 'expert'. As such it is more difficult to formalise and record. However, B-hive is concerned with providing a means by which this type of knowledge can, if appropriate, be codified and thus be made available for more widespread use and, indeed, created through the process of reflection and discussion facilitated by the COLA review process. An information system has been developed to support this process and to record and disseminate appropriate forms of the learning which results from the review.

Explicit knowledge has a role in the learning process and contributes to the individual's armoury required for his/her effectiveness within the organisation. However this alone is insufficient since business decisions often rely heavily on tacit knowledge which informs judgement, expertise, values and perceptions. The COLA process facilitates project team members to uncover and reflect upon their own unconsciously held tacit knowledge and make it explicit (Day, 1993).

Day (1993) considers reflection and identifies a number of assumptions:

- Engaging in reflective practice involves a process of solving problems and reconstructing meaning.
- Reflective practice is manifested as a stance towards inquiry.
- The demonstration of reflective practice is seen to exist along a continuum or 'reflective spectrum'. That is, it reflects different stages of development of the individual on a scale from non-reflective to reflective.

- Reflective practice occurs within a social context. COLA provides this social context within its workshops.

Day states that individuals spend most of their time planning and acting, much less on observation and reflection, and even less on justification of their actions. Reflection necessitates translating public theories into personal ones and vice versa. This process is illustrated in the following model of reflective practice (developed from Griffiths and Tann, in Day 1993):

<b>Reflective Cycle</b>	<b>Objective</b>
Rapid Reaction	Instinctive - immediate
Repair	Habitual, pause for thought, on-the-spot - short term (minutes/hours)
Review	Time out to re-assess – short-term (hours/days)
Research	Systematic, sharply focussed – medium-term (weeks/months)
Re-theorise and re-formulate	Abstract, rigorous, clearly formulated - long-term (months/years)
Integration of learning into individual's tacit model	Assimilation of knowledge and experience, defines the 'expert' - long-term (months/years)

**Table 1: Model of reflective practice and learning**

The model thus stated implies a linear process whereas the process ought to be seen as iterative enabling tacit knowledge to become explicit as each iteration progressively refines and enhances the individual's knowledge and expertise through reflection. Such reflection identifies recurrent issues and problems which need to be tackled or, if appropriate, evaluates the actions which have been taken to address them.

So far reflective practice has been discussed in relation to individual experience, indeed Barlow and Jashapara (1998) posit that for many organisations the experiences gained are at an individual rather than an organisational or corporate level. However, reflection, is not just an individual process (Harvey et. al. 1998), it can be seen as a social process (Elton et. al., 1989; Day, 1993). It is

“....a form of self reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of those practices, and the situations in which those practices are carried out”.

(Carr and Kemmis, 1986 in Schratz, 1993, p115)

A primary function of COLA is to provide a review process forum for the social construction of knowledge. This kind of knowledge may not already exist since it is concerned with the alignment of norms and values within the group; the group needs to establish what can be reasonably expected from each of its members. This knowledge is socially constructed because it is established through discussion and reflection upon past experience and future expectations. Such knowledge, when it is

generated, does not belong to an individual but can be seen to exist collectively within the group and it is subject to constant renegotiation.

Reflective practice can have benefits for groups and, consequently, the organisation as a whole since it contributes to individual learning and, when seen as a social process, it contributes to organisational learning. Individual learning on its own is not sufficient (Jones et. al., 1998) for the organisation to maximise the benefits to be gained from reflection. Individuals move around the organisation from team to team. They do not necessarily share their knowledge and experience with colleagues because the mechanisms do not exist to support sharing, or perhaps they just do not know how, or the culture does not facilitate sharing.

Organisational learning within the construction industry introduces an even deeper level of complexity since projects are not delivered by a single organisation. Within the context of true partnering, construction projects are delivered through virtual single organisations (VSO) involving the client and a number of other organisations such as, main contractor, architect, designers, project manager, quantity surveyors and specialist sub-contractors.

This has meant that the research project has gone beyond the traditional boundaries of individual organisations. Thirty years ago Felix Kaufman recognised that ‘company boundaries are not the only, or even the most meaningful, system boundaries’ (Kaufman, 1966) and suggested consideration of a ‘broader kind of “total system”’. Rather than consider a series of separate systems in separate organisations, we are redefining the systems and organisational boundaries to create the concept of a virtual single organisation that may exist for the duration of a single construction project or over a number of projects in the case of long-term partnering. ‘Single’ organisation because we are considering the partnership between multiple and varied organisations as acting in a way that goes beyond mere co-operation towards behaviour as a single entity.

The boundary of this VSO is defined by the functionality of the separate organisations required for the successful design and construction of a building. In considering the VSO as a single system we can capitalise on the desirable emergent properties. A synergy exists through focusing on the key processes within the VSO. Ideally, redundant processing will be eliminated as participating organisations are enabled to concentrate on their areas of expertise.

‘Effective communication across firm boundaries permits firms to focus more precisely upon those activities in which they exhibit some distinctive competence.’ (Borman, 1994)

Within this research project we are seeking to identify and engineer the business processes required for the design and construction of buildings irrespective of where and who performs them. In particular a major part of the research project is to identify the potential for learning within the VSO.

The membership of the virtual organisation will often change during the life of a large project and the representatives of each organisation on the project may change leading to the dissipation of collective and individual knowledge and the collapse of the social

networks which supported the social construction of that knowledge which gave it significance. It becomes “hidden in filing cabinets, in peoples heads, discussed covertly over the coffee machine or, indeed, forgotten” (Pedler et. al., 1996). Worse still people may leave the company carrying with them important information, which becomes lost to the organisation (Argyris and Schön, 1987).

Consequently the organisations within the partnership, and the construction industry as a whole, loses the opportunity to capture lessons learned for the benefit of future projects. The work of Scott and Harris (1998) and Weiser and Morrison (1998) show that few organisations have the procedures to “distil the experience.....from what is probably their richest source...” (Scott and Harris): their own staff! Project information is rarely captured and experience gained on a project may be lost if members of the project team are not provided with the opportunity and mechanisms to provide feedback (Barlow and Jashapara 1998).

Successful organisational learning within this context is dependent on fostering an environment of collaboration. Day (1993) argues that collaborative cultures, contract-making, entitlements and critical friendships built through openness and trust encourage team members to share problems and respond to new demands, reinforcing a sense of autonomy with responsibility by affirming confidence in each other. COLA can be seen as an important element in producing a culture which recognises the importance of both collaboration and reflection.

### ***The COLA environment***

The B-Hive project identified the problems confronting the construction industry as complex. Different participants hold both different understandings of the issues, have often competing goals and no certain and agreed measures of inputs, processes and outputs. The set of approaches and methodologies constituting *problem structuring methods* (Rosenhead 1989) were adopted both as tools for the academic/industry team to agree on their approach and, later as part of the interventions themselves. An exercise using Strategic Options Development and Analysis (SODA) (Eden, *et al.* 1979) led to the identification of the issues of post-completion review in projects involving the leisure company and the Management of Project Changes in those concerning the utility company. These key issues were seen to offer scope for exploring unexploited opportunities for learning within these partnering and value sharing environments.

B-Hive has run one-day post-completion review workshops with the leisure company. The first two, exploratory, post-completion workshops were run on the basis of value engineering techniques (Connaughton and Green 1996) drawing on the experience that the leisure company’s representative had in applying this technique. A major constraint on designing a workshop process for project review is the availability of staff and the length of time that they are willing to spend at a workshop. The experience of the exploratory workshops indicated that attention had to be paid to pre-workshop activities and to move some activities that are normally carried out within a workshop to the pre-workshop phase.

These considerations led to the development of a process model (figure 1). This was an attempt to identify processes to assist in project review in order to: promote the



sharing of knowledge across organisational boundaries; and identify the rôle that information systems can play in supporting the process. It also played a major rôle as a communication tool to build consensus amongst the B-Hive project team and to inform other workshop members about the process. The model enabled a dialogue between project members about the status of organisational knowledge and learning and through debates about the concept of a bank of acquired knowledge, the acceptance of the notion of tacit knowledge (Polanyi 1967). This also enabled an approach that placed emphasis on managers' understanding and interpretations of the world in which they work as a basis for moving towards action. (Introna 1997).

The COLA review process records and monitors key issues, decisions and actions surrounding these key issues ensuring that implicit learning is not lost throughout or on completion of the construction project. The term 'review process' is used which allows of a deal of flexibility in that many different procedures may be performed for a review. For example a review may involve workshops, meetings, teleconferences, videoconferences or any combination of these. So far the B-Hive project has mainly used workshops.

There are many situations that may necessitate the review process being triggered, for example:

- Programmed Review
  - Post Completion, leading to a review where the scope encompasses the construction project as a whole.
  - Stage Completion, scoped for a particular stage of the construction process.
  - Time based (e.g. period end, monthly)
- Non-programmed Review
  - Issue Resolution, necessitating a review to address a particular problem of high priority, for example running late or over budget or perhaps a technical difficulty.
  - Innovation, where a team has been innovative either in process or use of materials this experience should not be lost.

However all reviews facilitate critical reflection on past activities, focussing on individual and organisation learning and allows changing future actions to increase value to all participants

Within B-Hive we have developed the information systems required to support the COLA workshops,

### ***Supporting Information Systems***

Management trends - such as Business Process Redesign, Total Quality Management, partnering - have created the need for increased communication and collaboration across organisational boundaries (Scott J. E. 1998) facilitating the creation of the virtual organisation (Carayannis 1998). COLA promotes this communication between the partner organisations. Conventionally interfaces between partner organisations are often implemented through: written communication via the postal system, telex or fax; oral communication through the use of the telephone or face to face; delivery of

goods and services; and, increasingly, through electronic links either by simply passing data in an electronic form (Electronic Data Interchange - EDI) or through the development of Interorganisational Systems (IOS). There is a deliberate differentiation here between EDI and IOS. The UN Economic Commission of Europe's definition of EDI is:

‘the electronic transfer from computer to computer of commercial or administrative transactions using an agreed standard to structure the transaction or message data’ and ‘... between independent computerized systems’ (Hørlück, 1994).

EDI developed as the result of extending existing systems beyond organisational boundaries. However an important point to note is that the boundary of an organisation's systems does not extend beyond the organisational boundary of the recipient. It is the method of communication that is being automated. The recipient has its own independent systems which have to be capable of accepting the communicated data.

Interorganisational Systems (IOS) go further in that the systems in the separate organisations may utilise EDI but they are not necessarily independent of each other. That is, the information systems and data are a shared resource. Suomi (1992) examines a number of definitions of IOS and identifies the following three components:

- two or more organisations
- application of information technologies
- sharing of data and other resources

In many of the texts on EDI and IOS the focus has been on classic cases such as SABRE the American Airlines system. Such cases are cited as examples of how an organisation may improve its competitive position in the market place. However, most organisations are unlikely to benefit in such a dramatic fashion. Technology is advancing rapidly whilst costs of technology procurement are falling so that advanced technologies are becoming increasingly accessible. Technical innovations now provide only short term advantages until the technology is available to the wider market enabling the market followers to catch up to the leaders. In fact the implementation of EDI and IOS is now perhaps seen as a necessity for sustaining ones position (Swatman et al, 1994; Benjamin et al, 1990) rather than as a competitive weapon. Whether these types of system provide enough competitive advantage to justify the large investments necessary appears to be debatable. Technological leadership is not sufficient on its own to maintain sustainable competitive advantage (Meier, 1995) since technology can be imitated. We must therefore seek sustainability through co-operation and partnerships and through the redesign of operations and functions within and between organisations. Within this context ‘innovative companies’ are those that seek ‘not to perpetuate existing communication structures but to radically restructure them’ (Benjamin et al, 1990; Borman, 1994). This is particularly pertinent to B-Hive. The COLA information system is a first step towards the development of interorganisational systems for construction industry partnerships in that it promotes learning across all partner organisations by providing a repository which make critical project knowledge available as required to all partners (Scott J. E.

1998). This dissemination and sharing of project knowledge promotes more innovative use of knowledge (Agarwal et. al. 1997) facilitating collective learning.

The information system supports pre-review event, review event and post-review event activities. Pre-review event information is requested (via questionnaire) to identify major problems and issues throughout the lifecycle of the construction project. Currently the questionnaire is circulated to the construction project team members representing, where possible, all organisations of the partnership.

As a result of this data collection exercise, problems and issues, arising from the construction project, are collated, categorised and prioritised ensuring that only those perceived to be of major importance by the participants are presented for consideration in the review event. During the review event, actions, decisions and responsibilities are assigned and recorded against each problem or issue. The information system will monitor the performance and value of decisions made and actions taken. This information is currently held on a Microsoft Access database for demonstration purposes. It may be that the working implementation will be written using the existing architecture of the host organisation(s).

The database holds the descriptive information on the problems and issues. Each will have supporting historical data dispersed throughout the partner organisations held in many formats such as word-processed documents, spreadsheets, databases and drawings. Where feasible, there will be links between the data held on the COLA project review database and these supporting files and access will be via an extranet.

The COLA information system is not perceived as consisting solely of the Access database system. The primary function of the database system is to capture and process data centred on the review process, for example the following data may be captured and held:

- Pre-review event
  - Data on construction projects and partnerships enabling project team members to access construction project information required to set the context of issue(s) under review.
  - Data on events that may trigger a reflective review, for example the end of a construction stage or post completion or a significant issue.
  - Issue - this may be as a result of a major problem or perhaps where a course of action has resulted in a positive impact and the partnership do not want to lose the associated knowledge. The system facilitates the classification and prioritisation of the issues prior to the review so that a focus is maintained on key business issues during the review event.
- Review event.
  - Major decisions, actions and responsibilities from both the historical perspectives in terms of the construction project and those defined in the review event are captured on-line during the review event.
- Post-review event.
  - The effectiveness of decisions and actions taken is monitored to assess any value improvements resulting from the review process.

This information is made available to all partner organisations regardless of physical location and may be accessed through the use of an extranet<sup>1</sup>.

In addition to the data stored on the database there will be much relevant data stored in many different formats (word-processed, spreadsheets, other databases etc.) in many different locations across all of the partnership organisations. Such data is important to support, amongst other things, context setting, the prioritisation process, contact information and costings. Where relevant there will be active links between the COLA system and supporting files and documents.

It is the intention that the COLA information system will reside in an extranet environment from where it is accessible to all partner organisations. Conversely relevant files and documents held on computer systems within partner organisations are accessible from the COLA IS.

Development of the information system is technically feasible. The technology exists to enable computer communication between partner organisations. The real barriers to implementation are much 'softer': they are cultural. Suddenly we are placing organisations that are traditionally very protective of their data in a position where they are to give open access, to others, to parts of their systems. These are the challenges with which we are faced when considering further development of the COLA process.

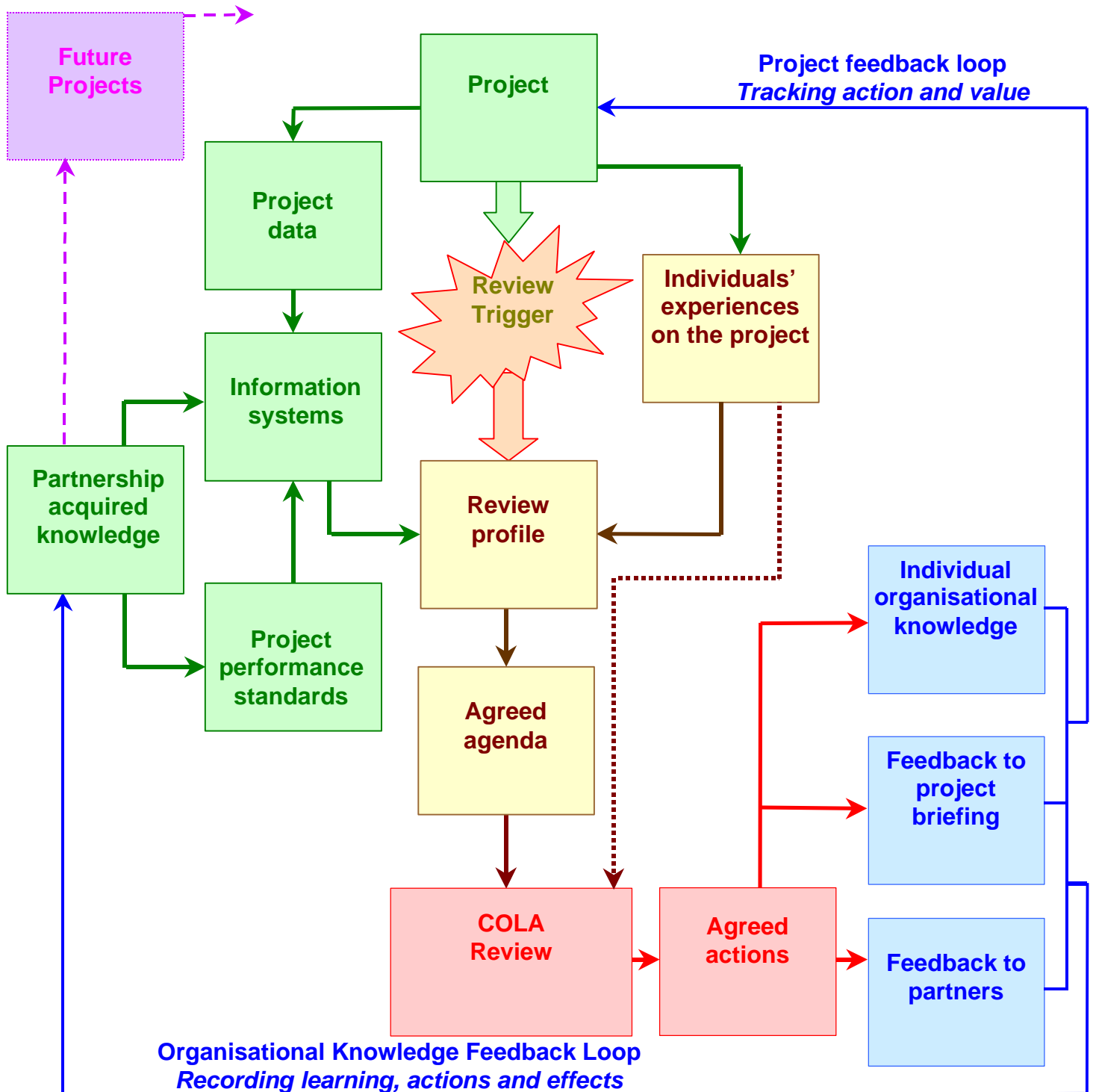
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<sup>1</sup> Extranet – an extended intranet which is a private business network of several co-operating organizations located outside the corporate firewall.

Intranets – are corporate information networks that use World Wide Web technologies and internet communications protocols. Definitions from Carayannis 1998.

Figure 1. - More information on COLA may be found at <http://is.lse.ac.uk/b-hive>

### The COLA Review Process



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