Practices and initiatives to transfer Simrac developed technologies to its stakeholders and other parties

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Synopsis

The genesis of Simrac's technology transfer practices and future initiatives are discussed in this report. Simrac produces a relatively large volume of research-based health and safety outputs that must be communicated to its tripartite stakeholders and to other interested and affected parties. The wide spectrum and complexity of the transferables, together with the diversity of end-user needs and skills of the recipient population, necessitate customizing of technology transfer practices.

In an attempt to optimize this process, a variety of practices are employed. Information is transferred by means of publication and dissemination of a variety of reports (paper, website and CD). Knowledge transfer is directed to health and safety practitioners by means of workshops, seminars, best practice booklets, handbooks and textbooks. Promotion of recently completed projects is directed at targeted recipients by means of project launches. Only isolated cases of piloting and implementation of technologies have been undertaken due to lack of resources and past organizational focus. It is anticipated that Simrac's new organizational structure and management system, together with end-user involvement by industry champions, from project inception to implementation, will enhance the effectiveness of the technology transfer process.

Introduction and background

Simrac funds approximately R40 million annually on exploratory and fundamental research, applied research and development, technology transfer, piloting, implementation, and promotion of safety initiatives. The number of projects that are in progress vary between 40 and 60 per annum. Duration of projects varies from six months to three years. The research focus areas are currently categorized into nine thrusts areas, namely:

- Behavioural safety
- Rockfalls
- Rockbursts
- Explosions and fires
- Machinery and transport systems
- Airborne pollutants
- Physical hazards
- Occupational diseases
- Special projects.

During the early 1990s, only isolated information dissemination took place and the communication of research outcomes was mainly confined to Simrac committees. In 1997, the organizational structure was enhanced with a full-time technical manager and additional administrative staff. This facilitated the establishment of a formal information dissemination system to end-users and stakeholders and limited technology transfer. During 1999, three programme managers were appointed to manage occupational health, rock engineering and engineering and machinery-related projects. No formal or dedicated technology transfer function was catered for within the structure.\ (Figure 1).

Simrac is a permanent committee of the Mine Health and Safety Council and is constituted on a tripartite basis. Simpross (Simrac Project Support Services) consists of management, technical and administrative staff that facilitates the expediting of the annual programme. Simgap and Simcom represent tripartite committees that oversee the gold, platinum, coal and 'other' mines portion of the programme and are assisted by two expert groups, Simrock and Simeng. The Simhealth committee consists mainly of occupational medicine and hygiene practitioners and operates across mining sectors.

During the late 1990s, Simrac realized that its technology transfer initiatives were not balanced against its research efforts, and a project was commissioned to assist in the formulation of effective technology transfer strategies. An insightful recommendation

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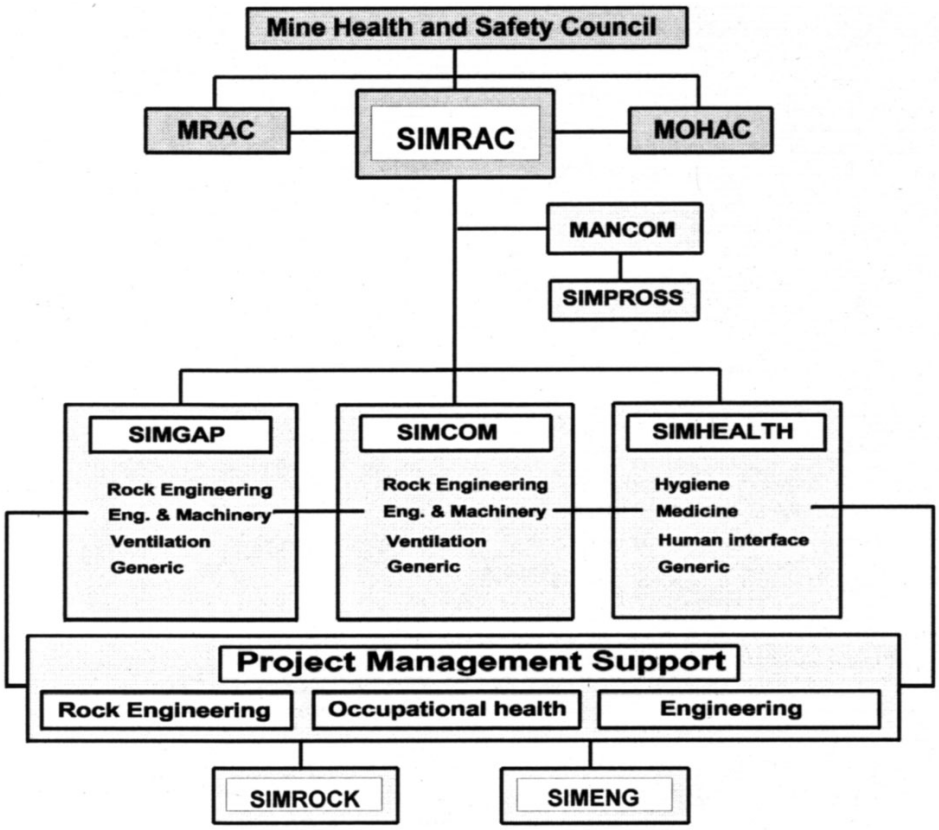

Figure 1—Simrac's former organizational arrangement, a matrix structure between sectoral committees and functional-based technical experts

arising from this project (GEN 504) can be summarized as follows:

'It is essential that priority be given to successful technology transfer, that best practices are acknowledged, that an enabling environment is provided in which to operate, that a thorough understanding of the benefits of technology transfer is instilled in all stakeholders and that key role-players engage in building relevant capacity.'

The outcome of a strategy workshop, which was held during November 2000, identified several issues to enhance the organizational effectiveness of Simrac. In particular, the establishment of sustainable technology transfer mechanisms and the involvement of industry users from project inception to implementation stage were identified as critical issues. Several strategic interventions and structures have been formulated with a view to embedding technology transfer as a permanent and sustainable component of Simrac's primary function.

Technology transfer : Simrac's mandate and involvement

Although Simrac's primary function is to initiate and manage health and safety projects, the '...**communication and publication**' of research results is the only activity that has an element of technology transfer. No mention of technology transfer is made in the section of the Mine Health and Safety Act that relates to Simrac's duties and responsibilities and hence the accent of the annual programme has been on research and publication. The organizational structures, procedures and allocation of resources that were in operation during the late 1990s, were not aimed at transferring newly developed technologies and hence technology transfer is not reflected in the mission statement:

'To initiate and manage research aimed at improved understanding of significant occupational health and safety risks; the development of solutions that will lead to improvements in occupational health and safety conditions and performance in the South African mining industry and to advise the Mine Health and Safety Council on matters as required by the Mine Health and Safety Act (Act no. 29 of 1996)'

Simrac's involvement in technology transfer should be guided by the requirements and conditions that are inherent in the transfer process. This process should be a bipartite, managed activity of:

- communicating information, imparting knowledge, demonstrating products, services, processes and systems and facilitating piloting by a technology provider, and
- the receipt, acceptance, sharing of ownership and initiation of implementation by technology recipients and users.

According to this definition, technology transfer is not merely an event, but a managed process that involves personal interaction between two parties who must be mutually dependent and committed. If these conditions are not present, the potential benefits of innovation, research and development, productivity and safety will not be realized.

There are several reasons for and impediments to establishing sustainable technology transfer within Simrac and these are briefly discussed in the next section.

Typical barriers to technology transfer

The main barriers to successful transfer that have been identified can be summarized as follows.

- During the first few years following its inception, Simrac did not appreciate the need to have a formal dedicated technology transfer strategy as communication and publication of research results were deemed adequate. The onus was placed on mines to act on recommendations.
- Simrac did not plan nor allocate funding for the dissemination and publication of research results and assumed that the assimilation of changes in technology would result from technology-pull by mines.
- Because of their non-involvement and non-ownership of projects, end-users are not convinced that the adoption of new technology would be beneficial.
- The majority of mines do not possess the organizational culture, skills and procedures to utilize new technology. Planning and budgeting for new implementation of new technology are therefore seldom formalized.
- The long-term value of new technology is often not supported by senior management on mines (who often have a relative short tenure and are unwilling to support long-term technology development).
- The Mine Health and Safety Act is silent on technology transfer; only research programme content, costs and the *communication* of research results are required.
- There is no 'recipe' for success and every technology transfer must be customized according to the needs and receptiveness of the recipients.
- Simrac has only recently started to produce more tangible and implementable project deliverables.

Technology transfer practices: past, current and future

The first Simrac projects were started in 1994 and, to date, more than 217 reports have been completed with a further 85 in progress. There has been a marked change in the type and nature of research since Simrac's inception with commensurate changes in technology transfer practices. The progression of technology transfer practices will therefore be discussed for three different periods.

The period: 1994 to 1997

The type of research was mainly exploratory in nature and aimed at expanding the knowledge base and basic understanding of safety hazards, mainly rock engineering. Final reports were disseminated to selected committee members and interest groups only. The reports were very technical and formal with minor transferable content and few recommendations for implementation. Project scopes had no defined technology transfer deliverables. No procedures were in place for dissemination of reports. During this period, the annual research programme was arranged into gold and platinum, coal, 'other' mines and generic projects in accordance with the levy imposed on the different mining sectors. Project management was done on a functional basis with rock engineering, engineering and environmental advisory groups and special interest groups advising sub-committees which reported to Simrac. During this period, the number of committees and groups varied between 12 and 14.

This period is typical of an approach that assumes that technology transfer is a **passive** process between the developers and users. The process is only initiated on a needs-driven basis and only existing structures and links are utilized. Deliberate technology transfer mechanisms are not considered necessary.

The period: 1998 to 2001

The spectrum of research was expanded by including occupational hygiene and occupational medicine to the portfolio. The nature of the project deliverables moved from fundamental to more applied and development content aimed at producing potential solutions and not merely better understanding. A new, more systematic and reader-friendly report format was introduced with more accent on recommendations for possible implementation and technical content was presented in a more digestible form. Project scopes outlined potential technology transfer components and mechanisms.

Systematic dissemination procedures and channels (websites, CDs and newsletters) were established to distribute all completed reports to levy-paying mines, tripartite institutions, libraries, and selected institutions overseas. Comprehensive handbooks on rock engineering and occupational health were produced that summarized best practices and accumulated knowledge and research findings. Well-illustrated booklets were produced that were presented to selected user-groups at special project launches. A few mine-based user-groups were established to obtain input for projects that will produce tangible and implementable project outputs. Several equipment prototypes were produced and tested in the user-environment. During this period, two projects (GEN 504 and GEN 604) were commissioned to recommend practicable technology transfer strategies for Simrac

This period is typical of a dissemination approach that recognizes that R&D is being under-utilized and establishes dissemination mechanisms to inform potential users of the available research outputs. Initiatives are typically technology push in nature and although end-user involvement is recognized as being pivotal in the process, the researcher is

still viewed as the primary agent to transfer a particular technology. There is a realization that technology transfer needs to be a systematic process with buy-in from end-users.

The period: 2002 onwards

Strategic workshops were held towards the end of 2001 at which several critical technology transfer issues were identified and strategic and tactical plans, organizational structures and resource allocation, were formulated. Simrac's technology transfer has progressed towards a knowledge-utilization approach that will involve all role players, users and producers of technical research to explore implementable solutions, some of which may have commercial applications. The focus will be on structured, interpersonal interaction between technology developers/owners and recipients, designed to reproduce technical knowledge, apply new applications and jointly initiate novel technologies. An integrated *market-pull* model is the preferred approach that will be pursued because receiver organizations will play a significant role in defining relevant, needs-driven technology that will be transferred. The technology transfer processes will be understandable and demonstrable, as many of the transferables represent people-embodied technologies that are more difficult to transfer than product-embodied technologies. Some of the changes that have been introduced are discussed next.

The organizational mission

The scope of the mission statement was amended to include technology transfer and points to the aims of the research:

- the initiation and management of research and surveys aimed at eliminating, controlling and minimizing occupational safety and health risk to persons at mines
- the facilitation, promotion and communication of knowledge, transfer of technologies and piloting of implementable solutions that will lead to improvements in occupational health and safety conditions and performance at mines, and
- advising the Mine Health and Safety Council on matters in accordance with sections 43(1) and 42(2) of the Mine Health and Safety Act.

Information presentation will be further advanced towards uncomplicated, concise formats in reader-friendly style and if applicable, interactive in nature. Simrac information will be free with no access restrictions. A key element will be the appointment of credible and motivated technology champions who are familiar with organizational and individual dynamics, who can communicate effectively with end-users. Ideally, technology transfer management should be a dedicated function that aggressively promotes research results and practicable implementation plans.

Several new safety-related technologies have emerged through technology push, for instance, self-contained self rescuers, hydraulic stope support, seismic monitoring systems and trapped miner location systems. A balance between technology-push and market-pull will therefore be pursued to optimize potential technologies.

Changes to the organizational structure

Simrac has restructured its management systems by investigating the establishment of a simplified, practicable arrangement that incorporates stakeholder involvement, professional programme management and technology transfer components. Simrac will continue to focus on policy and strategic issues, while Simpross will be responsible for the execution of the annual programme and the provision of administrative and management services. Input from a multi-disciplinary advisory panel of consultants and auditors will be solicited to assist with organizational issues, including technical and technology transfer and promotional aspects. The new structure is depicted in Figure 2.

Incentives for technology transfer participants

A key element for ensuring successful and sustainable transfer of new and developing technologies is the provision of incentives for participation. Simrac is investigating the possibility of instituting compensation for participation by mines, end-users, champions and manufacturers in Simrac projects. Ideally, involvement of all participants should be formalized with a guarantee of compensation during the project's life cycle for expenses incurred during the period of participation.

Champions will be invited to selected meetings and discussions and should be released from their normal duties to participate in Simrac business. Potential participants in future projects will include a variety of stakeholders that will be actively involved during the duration of the research, development and implementation phases. (Figure 3)

Outsourcing of routine technical auditing and quality control

Simpross management will employ consultants for auditing and verification of technical content of reports and for other diverse tasks that require specialist assessments. It is envisaged that such an arrangement will allow Simpross to facilitate more end-user involvement and liaison with champions. The focus of Simpross' current primary functions will shift from project management and quality control, towards integrated programme management and the facilitation of technology transfer.

Project phasing, scoping and funding allocation

Projects commencing in 2002 have been formulated to incorporate phases, (exploratory research, development, transfer/implementation) and if applicable, commercialization. Technology transfer will thus form an integral part of the contractual project deliverables.

It is imperative that organizational interventions, such as the establishment of sustainable technology transfer

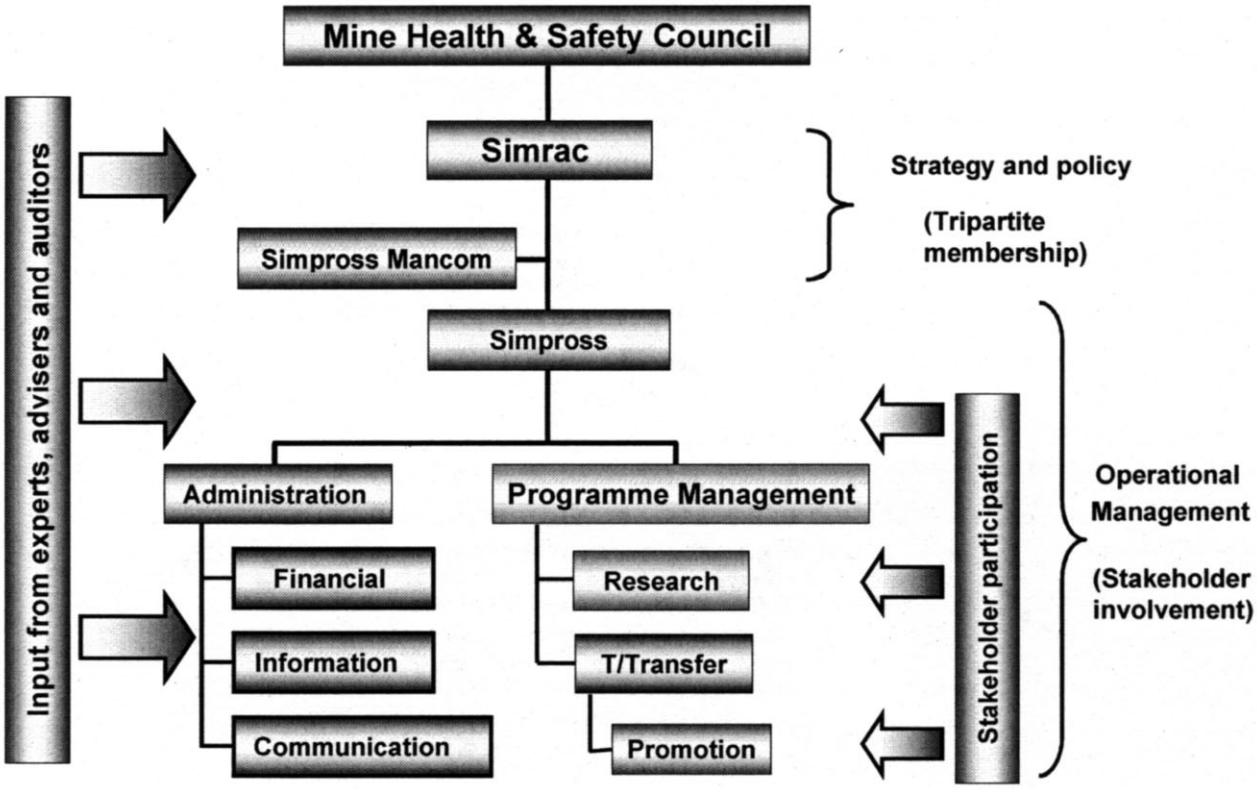

Figure 2—The new organizational arrangements. Technology transfer is now a recognized Simpross function. Involvement of technology champions and end-users are included under 'stakeholder involvement'

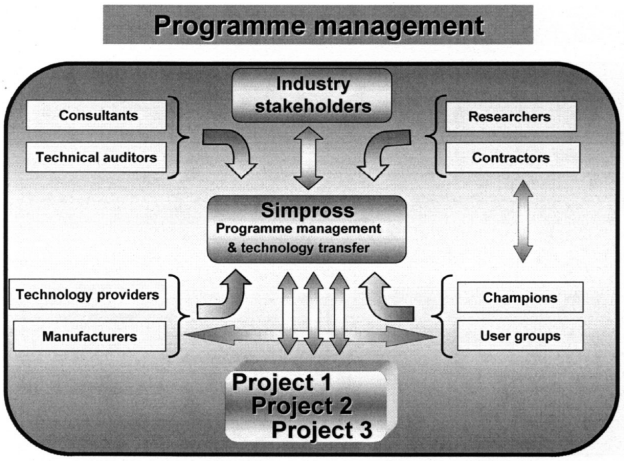

Figure 3—Participants in the research-technology transfer chain

strategies, should be grounded on shared vision, adequate capacity and practicable implementation actions. Elements that were considered during the formulation stage are depicted in Figure 4. This matrix will be used to assess the effectiveness of the resultant change outcomes during 2002.

Summary of Simrac technology transfer initiatives

Technology transfer of Simrac-sponsored project deliverables and technologies is relatively new and has to cater for a wide spectrum of recipients that include Labour unions, the Department of Minerals and Energy, employers, researchers and manufacturers. Figure 5 summarizes the nature and frequency of techniques that have been employed to date.

Conclusions and recommendations

Simrac is committed to embedding organizational structures and mechanisms within Simpross and Industry with a view to enabling sustainable technology transfer and end-user involvement. During the past few years, there has been a steady increase in technology transfer effort, which has progressed from a passive approach to a more active and integrated approach, The spectrum of future research-related functions has been widened to include development, piloting and implementation of project deliverables and project scopes have been expanded to incorporate technology transfer as a deliverable output. The participation of technology champions and incentives for continued involvement are key success factors to ensure the practicability and motivation for implementation.

Managing the appointment and continuity of part-time industry champions and their interaction with Simrac and Simpross will be a challenge within the current skills supply and economic constraints within the different mining sectors. Simrac evaluated the incorporation of four full-time industry representatives to liase, champion and promote Simrac projects, but it was considered to be relatively costly. The effectiveness of the current arrangements will be reconsidered in 2003 and amended if required.

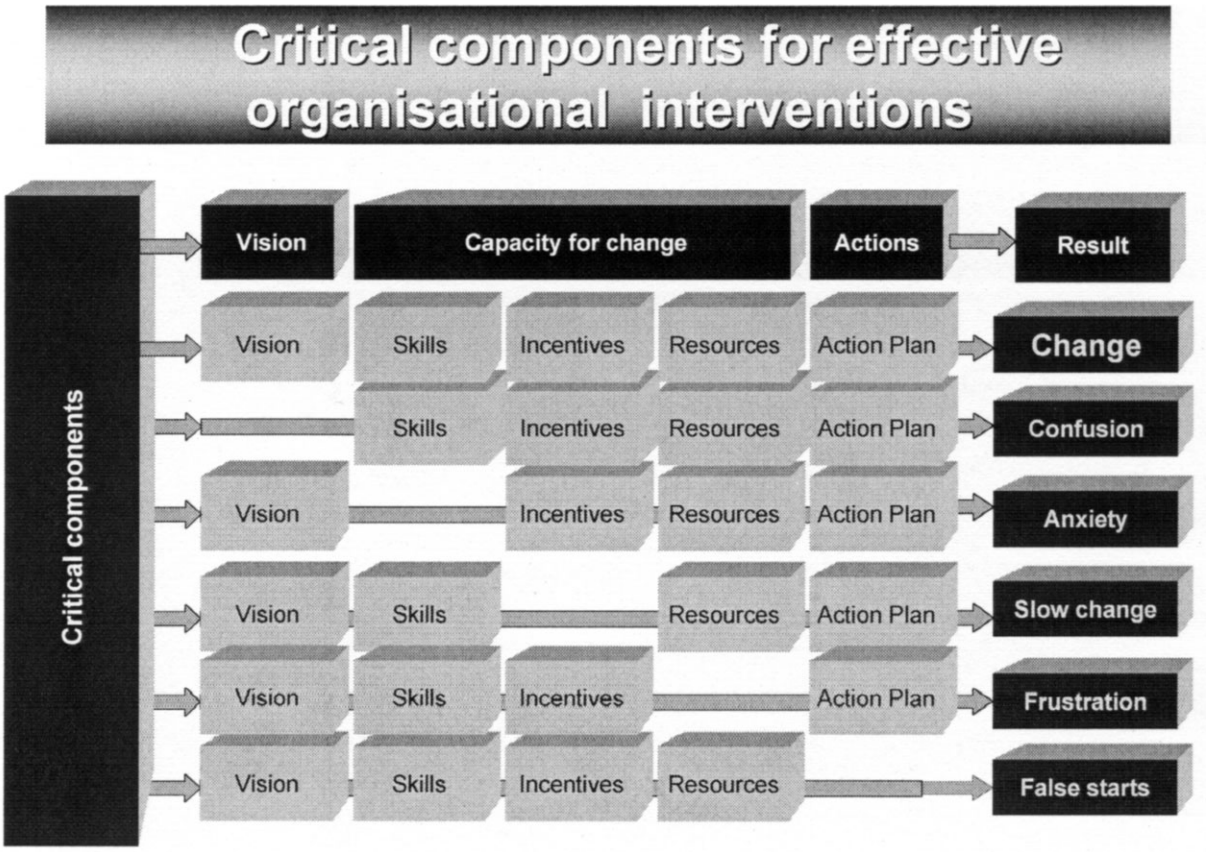

Figure 4—A diagram to assess outcomes of organizational change

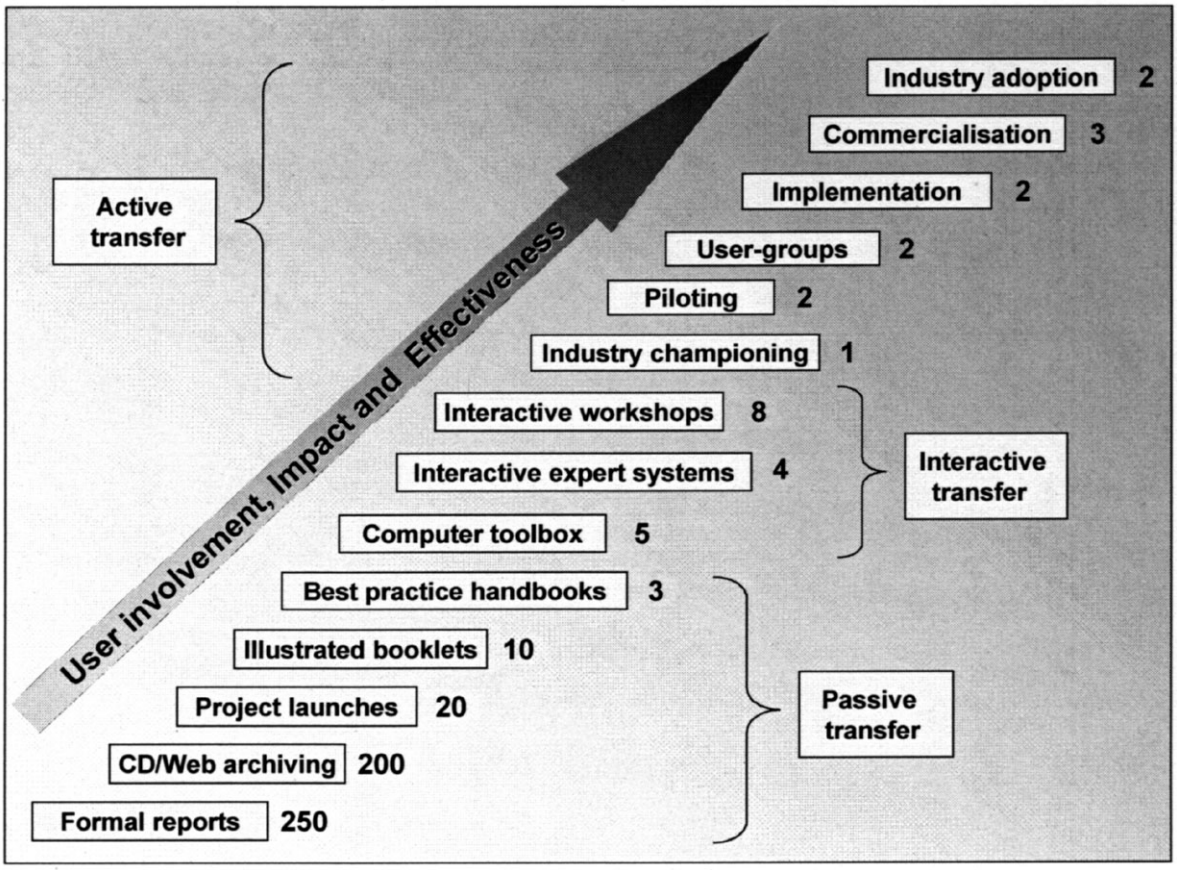

Figure 5—A summary of technology transfer types and techniques. Numbers represent the approximate frequency of adoption by Simrac