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P-D-R Blueprint for an Ideal Corporate Information Center

Oliver Renn (1), Michael Archer (2), Carmen Burkhardt (3), Jeannette Ginestet (4), Henning P. Nielsen (5), Joanna Woodward (6), P-D-R Library Affairs & Copyright Group***

(1) Oliver Renn, Director, Head Scientific Information Center, Boehringer Ingelheim & Co. KG

(2) Michael Archer, Licensing and Delivery Manager, AZ Library, Astra Zeneca

(3) Carmen Burkhardt, Head of Information Acquisition, Novartis Knowledge Center, Novartis Pharma AG

(4) Jeannette Ginestet, Head Information Acquisition and Contract Management, sanofi-aventis recherche & développement

(5) Henning P. Nielsen, President of the P-D-R, Director Novo Nordisk Library, Novo Nordisk A/S

(6) Joanna Woodward, Joanna Woodward, Director, Library and Information Services, Pfizer Inc

* Correspondence Author (olrenn@aol.com)

** The P-D-R is an association of information managers in 24 of the biggest global pharmaceutical companies.

*** as of June 1, 2012, O.R., M.A. and J.G. are no longer with Boehringer Ingelheim, AstraZeneca and sanofi-aventis, respectively.

Introduction - Why a Blueprint of a Corporate Information Center?

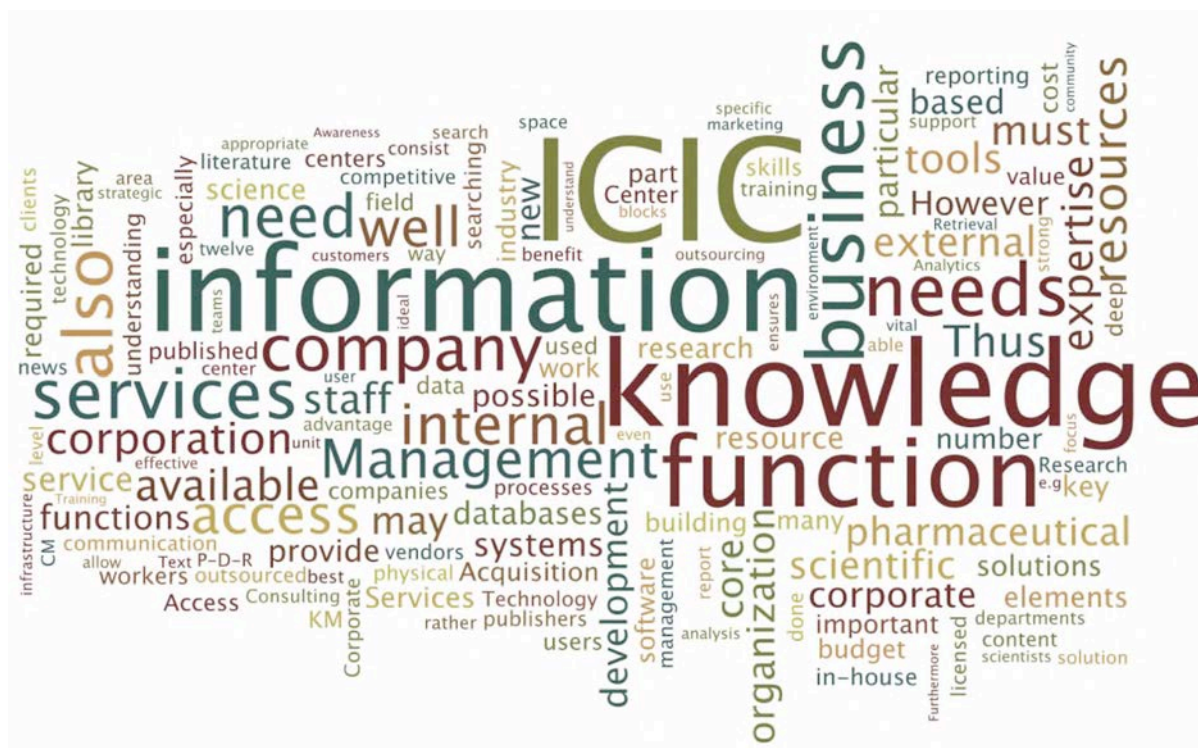
Innovation is fostered by information and knowledge. Information therefore has always been a key competitive asset in any research based corporation and fundamental for decision making on all levels. Hence corporate libraries, managing this key asset, have formed a natural and indispensable function for any R&D driven business and enterprise for many decades. The last 20 years have transformed the information world and libraries have played a very active role in this transition. Following and paralleling the transition of publishers into information solution providers, corporate libraries evolved into information management and knowledge centers. This transition has turned them into innovation partners rather than raw information providers or physical shelving facilities.

Especially in the pharmaceutical industry, organizations and functions are constantly adjusting to leverage any financial or competitive advantage. This applies equally to corporate scientific libraries or information centers which, within a technology-enabled landscape and tight resource management, are expected to constantly gain efficiency, and to provide greater value while serving a global community consisting of interdisciplinary multi-site teams. Thus, corporate information centers (this term will be used within this article) are constantly facing reorganization and need to define the functions that are required to fulfil the tasks of fostering innovation, enabling access to internal and external knowledge, and integrating content into the workflow of corporate knowledge workers.

There are only few publications that deal with life sciences libraries or corporate information centers at all. One, entitled “2015 – The Future of Medical libraries” [1] tried predict what would happen to medical libraries in the post-Google world but did not discuss developments in a corporate setting nor describe the functions needed to have future-proof organisation that helps developing better medicines. Other focus on benchmarking, best practices or needs assessments [2–5].

Therefore, the P-D-R (Pharma Documentation Ring), an organization that represents the scientific information departments of the leading R&D-based pharmaceutical corporations, worked on a blueprint for an Ideal Corporate Information Center (ICIC), a blueprint that may be used by any company – not only in the pharmaceutical industry. The P-D-R has defined twelve building blocks of which such an ICIC should consist, which are described in the following sections. In the last section, it is discussed how an ICIC could be integrated into the corporation.

Figure 1. The tag cloud, derived from the contents of this article, visualizes an Ideal Corporate Information Center (tag cloud generated using www.wordle.net)



The 12 Core Elements of an Ideal Corporate Information Center - Highly interlinked, preferably centrally organized

Corporate information centers can be organized in multiple ways but there are a set of core functions that need to be part of any information organisation. The following twelve core elements (fig. 1) are not required to be *organizational* units within an ICIC but rather functions the ICIC should include. Subsequently, some of these twelve elements could be merged into one organizational unit, embedded in other business units within the corporation. However, in an ideal world and due to the project-based nature of the work, to maximize the impact of the ICIC on the competitiveness of the corporation, in our opinion an ICIC should integrate all these core elements.

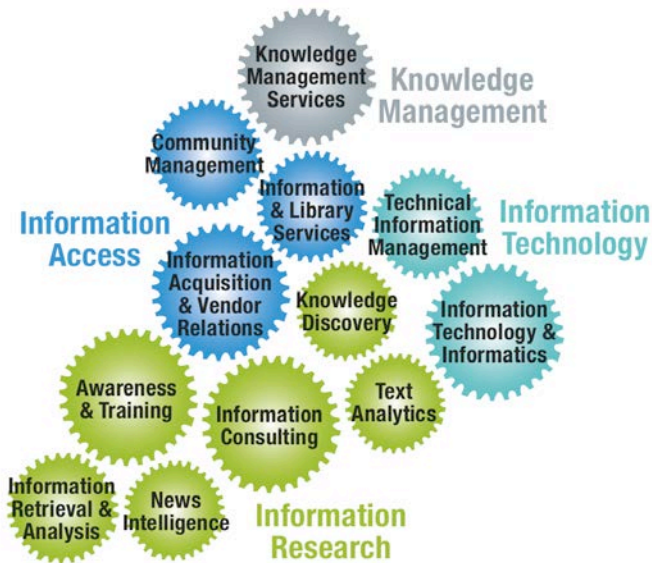


Figure 2: The twelve core elements of an Ideal Corporate Information Center.

In the following, we describe and define the core elements that can be organized into the categories, Information Access, Information Research and Information Management. The three pillars *Information Access*, *Information Research* and *IT Architecture*, which consist of the eleven core elements, form an Ideal Corporate Information Center. The Blueprint that is derived from this concept is fully scalable and future-proof. As it will be shown later, these three pillars result also in efficient Knowledge Management and make the information and knowledge assets of a corporation accessible. They also address the recurring statement “We don’t know what we know” so often referred to in information management initiatives. Thus, in support of knowledge management, we add a twelfth element, *Knowledge Management Services*.

I. Information Access

The three core elements summarized under “information access” ensure that the content that drives a corporation’s R&D business can be acquired – by providing adequate funding and technical infrastructure – and disseminated to meet the company’s specific needs. *Information access* is the foundation for getting business critical R&D processes and decision-making right.

1. Information Acquisition & Vendor Relations

Pharmaceutical R&D draws its lifeblood from internal and external information and knowledge, the latter being obtained from publishers and information solution providers. Having access to the most relevant and recent information with minimal information overload is a clear competitive advantage for any knowledge worker [6] in the pharmaceutical environment and subsequently for the corporation.

The *Information Acquisition & Vendor Relations (IA&VR)* function serves as a center of expertise for the procurement and licensing of externally published information resources to support all knowledge workers with their information needs across the organization globally, at the same time leveraging the corporation’s buying power, ensuring effective processes and compliance with copyright laws to protect the organization. The tasks of the function span the whole knowledge management life cycle, from information audits, identification and prioritization of user needs, content and vendor evaluations, license negotiations and coordination with pro-

curement up to supporting the deployment of the licensed information resources, access management, and the ongoing contract and strategic vendor relationship management, including the development of partnerships. The number of FTEs involved with this function can be reduced if acquisition is done centrally and on a global level. Handling large corporate-wide license agreements with the major information providers in-house has the key advantage of having the knowledge on internal customers' needs, the corporation's IT environment and in-house systems at hand. No external company will get the same level of knowledge on these important factors.

A strategic, direct partnership with the major information providers can be very advantageous in terms of establishing a long-term relationship with direct negotiation power, getting first hand information on future development plans and negotiating favourable package deals. The balancing act between user needs, available funds, internal Service Level Agreements and negotiations with vendors can be best handled if everything is in one hand, i.e. centralized or at least coordinated within the IA&VR function. This ensures that funds are ring-fenced to avoid fragmented purchase patterns or budget cuts. For smaller or local license agreements as well as for special niche products the outsourcing of the licensing to a reliable, neutral third party agent might be beneficial for both parties, especially in order to manage the routine work.

2. Information & Library Services

Information & Library Services (ILS) is the link between *Information Acquisition* and *Information Management*. In a self-service driven information center it provides end-user services, either by providing the service itself or by arranging the services when outsourced. *ILS* ensures that access to published information is facilitated, either through direct access to subscribed content or through document delivery services for non-subscribed content. The function ensures that the company benefits from the most cost effective subscription deals with the publishers to access literature (Referenced in Section 1 – Information Acquisition & Vendor Relations). This function also ensures that legitimate copyright cleared copies of the material are available for further internal distribution. Lawsuits following copyright infringement are a serious threat and can seriously damage the company's reputation.

ILS within a pharmaceutical company is a combination of services traditionally to be found in the physical libraries. Only a small proportion of physical collections are now kept at a location that can be "browsed" by customers or be put on circulation. Thus, services no longer deal with the physical delivery of information but instead focus on enabling access, via link resolution technology, to subscribed e-resources and to document delivery services for any articles, reports or chapters not owned or licensed. The third responsibility for this function will be to act as the front line on copyright compliance in collaboration with the corporate legal group. Internally the *ILS* contributes to the annual renewal cycle of assessment and negotiation of subscriptions to journals, databases, reports etc., based upon feedback from clients and analysis of usage statistics. Some other services offered may be i) literature surveys for submissions, ii) maintaining a Product Literature Database, iii) translations of articles, iv) impact factor support, v) author publishing approval, vi) small volume commercial reprints provision.

As with any service function, it is sometimes preferable to outsource tasks. The greatest examples for outsourcing models are when the vendors are specialists themselves in the provision of that service, and where it would cost more to provide the service in-house. Document delivery or book cataloguing are transactional supply-chain services well suited for outsourcing.

3. Community Management

It is obvious that an ICIC, especially a virtual one, must be in close and permanent contact with the user. How this is done most effectively depends on the size and organizational structure of an ICIC. In a virtual environ-

ment, *Community Management (CM)* must focus on a well-designed information dissemination structure (a portal or other means of visualisation) based on roles and workflows rather than traditional catalogues. Content must be aggregated into the workflow of the knowledge workers. An ICIC must maintain close customer contact to ensure that services are proactively and constantly aligned to the companies goals. Thus, the marketing of the service is not just Public Relations, but much more of a tight interaction with ICIC's clients and management.

CM must help to secure the appropriate funding and support from the management to keep the corporation competitive with regard to the resource "information." Thus, it is of vital importance that an ICIC constantly and consistently advertises the service to ensure colleagues know what is available and how they can benefit. Furthermore, *CM* brings together local or topic information teams, and organizes global information meetings and/or stakeholder advisory boards. Additionally, CM can play a role in internal cross charging or budgeting issues.

CM must consist of skilled staff with dedicated time for (i) building the ICIC communication strategy, setting the standards for the ICIC visual identity, branding, communication channels, etc., (ii) reach out to stakeholders and management, and (iii) coordinate and perform active marketing of information resources and services through company communication channels, ICIC websites, ICIC deliveries, presentations, virtual and physical communication. As CM and community building requires a high degree of familiarity with the solutions offered by the ICIC it is natural that CM, like KM, is less an organizational unit but a spirit the entire ICIC must share. Strategy development and marketing campaign activities can be very successful with external consultancy as one off events.

Information Access Staff Skill Sets

Staff that drives the *Information Access business* of an ICIC need to have information management, information science [7] or library science skill sets.

Successful handling of *IA&VR* requires special areas of expertise: Information management skills, sound knowledge of the information industry market and the key players in this field, and an in-depth knowledge of the internal customer base and their business needs. These key strengths enable the function to understand, prioritize, and respond to the customers' information needs, create innovative solutions and negotiate deals that correspond to the users' needs whilst at the same time ensure that services are delivered in the most cost effective and efficient way. In addition to strong negotiation skills, financial management skills are also required as the budget is very often a large percentage of the total budget of the unit into which the ICIC is reporting. Additionally, a deep knowledge on copyright and legal issues is required.

Qualified, professional librarians are needed to manage *I&LS*, in particular for leading collection development, cataloguing, classification work and indexing, linking, and tagging content for retrieval purposes. They are the experts in information organization and thus an indispensable resource for an R&D driven business. For *CM*, staff experienced in external and internal communication as well as marketing is needed for building the strategy and coordinating the marketing and communication activities. Excellent communication and presentation skills, combined with business understanding and marketing training is required.

II. Information Research

While *Information Access* is preparing the ground for the successful use of information, *Information Research* ensures that the money spent on information and information access have multiple returns, by boosting innovation and saving expenditures in R&D as well as all other information intensive processes in the corporation.

This is done both by reaching out to the knowledge worker, the ICIC's clients, by listening to them and providing individual consultancy and highly customized information solutions and services.

4. Awareness & Training

Information, particularly scientific information, and subsequently the knowledge derived from published information, is the vital resource of all knowledge workers in the pharmaceutical industry. Information must be successfully implemented into the workflows of knowledge workers, simultaneously ensuring information literacy and awareness of what is available for solving a particular problem or being alerted to recent information and knowledge. This is particularly important, as publishers have transformed most of the information resources into end-user tools.

In an ideal world, Awareness and Training (AT) should be complemented by a program for continuing education in the company. Education and Training is also one of the pillar of the Innovation Medicines Initiative, a 10-year initiative, set up by the European Union and the EFPIA and the EC, aimed to enhance the competitiveness of the pharmaceutical sector in Europe for the benefit of both patients and scientists [8]. AT must ensure that any employee who can benefit from available internal and licensed information resources and tools is fully aware of what is available and how to use it. In addition to the awareness program, the function should develop a curriculum that is specific for certain user groups, in particular for heavy users of information, e.g. scientists in research, development and medical departments. The curriculum can consist of class-room training, e-learning or web meetings. While the program needs to be developed internally, modules from publishers or vendors can be used. However, external trainers may be biased or do not know about internal needs or specifics. Ways to encourage attendance will differ among companies, linking it to introduction sessions for new employees or compliance training are ideas that have worked in the past.

The degree of outsourcing in this area can depend on the size of the function. However, training and awareness programs are better developed by internal staff, as they understand the business environment and the full range of products available from different vendors. Vendors may well be best placed to provide product-specific training.

5. Information Consulting

Today, there is a large number of databases, both commercially available and open access, that could potentially be used for solving scientific and business questions. Thus, it is impossible for all knowledge workers to oversee the market, and to be familiar with the increasing number of databases and business solutions that are continuously changing. Therefore, it is crucial to have individuals in the company that are able to oversee the entire portfolio of databases and information solutions tools and can provide scientific consultancy, ideally as members of project teams. Thus, knowledge workers and their projects benefit from the existing resources and information solutions – a clear competitive advantage.

While *Awareness and Training* aims to lay the foundation for information literacy and the appropriate use of licensed and freely available information resources and tools, *Information Consulting (IC)* focuses on supporting end users with a particular scientific issue to solve. In these cases, it might not be obvious which information resource or tool might provide a solution or how the question could be translated into a query. For the latter, a deep scientific expertise in the particular research field is mandatory. Furthermore, an information consultant has to be aware of any information resource and tool in his field of expertise. This is only possible if the information consultant is able to concentrate on the research field to which he is assigned and keeps pace with the latest developments in science. It is also a prerequisite for success that the information consultants are *embedded* scientists, being part of project teams. Consulting provides help and guidance to end users, supporting

and pointing them to the right information. As this may in some cases also include expert searching there is an overlap with *Expert Searches*. However, *IC* is considered to be more strategic, while *Expert Searches* actually provides a more standardized and frequent search service, where the results are presented to the customer in an appropriate manner (in particular patents, business analysis and competitive intelligence).

IC cannot be outsourced as a deep knowledge of existing information resources is required and most of the consultancy requests would require a Non-Disclosure Agreement. Additionally, the huge benefit of having *IC* contribute to other functions, in particular with regard to database evaluation and portfolio management, would be lost.

6. Information Retrieval & Analysis

An *Information Retrieval & Analysis (IR&A)* function is business critical for any pharmaceutical company as their work supports decision-making, adds competitive advantage, and last but not least, addresses information overflow. Here, information overflow is not only caused by the increasing numbers of documents that may be retrieved but also the increasing number of databases and information systems that can be used. Thus, it is not only a matter of successfully handling information overload but also dealing with duplicate and multiple pieces of similar information as well as the decision as to the reliability of a resource.

The function is of vital importance for Patents Departments, R&D, Medical, and Business Analysis & Development, which have either a need for retrieving reliably *all* published information (Patents) or for other areas where particular knowledge about the where-and-how to retrieve requested information is required, e.g. by means of complex search strategies. Thus, the function should be very much aligned to the four customer groups Patent, Medical, R&D Information & Competitive Business Intelligence.

Another reason for such a function is that some databases are not designed as end-user tools and therefore not available to the broad user community. Searching these resources requires expert knowledge and can be costly in terms of time and budget. Thus, information professionals should handle searches, being supportive and supplementary to end-user searching in databases and systems provided by *Information Acquisition*. Other tasks include strategic information surveillance and alerting services, ranging from basic alerting profiles to compiling newsletters and intelligence services containing analysis and commentary on the potential impact of the reported information on a specific company.

Interaction with stakeholders and integration of in-house information is of critical advantage; however, ad-hoc searching and basic analysis may be outsourced under surveillance of in-house experts. Some companies outsource critical patent searches to consultant law firms, as an “insurance back-up” to their internal patent search efforts. However, in most cases access to databases that are licensed in-house cannot be granted to external companies, thus, these search results depend on the information resource portfolio of the outside partner.

7. News Intelligence

As major parts of a pharmaceutical company rely on news, there is a business-critical need for a function that provides relevant business and scientific news targeting the specific communities in a corporation, i.e. by media monitoring and trend spotting. As the ICIC is dealing with information and knowledge, and their vendors, it makes sense that *News Intelligence (NI)* should be part of the ICIC. Often this is done in close collaboration with the cooperation’s Communication or Media Relation teams.

NI is responsible for the global and concurrent surveillance, evaluation, and dissemination of information in the news media relating to the corporation, its competitors, its business areas, and other issues representing threats or opportunities. It offers news(letter) platforms with alerting functions in general as well as in special-

ized fields relevant to the company. Deliveries range from real-time to daily, weekly, or monthly consolidated news updates.

Aggregation of news sources and basic alerting with raw information may be outsourced, but profiling of alerts, consolidation and analysis needing deep business understanding must be based on internal skill sets.

8. Text Analytics

As the amount of published information is continually growing exponentially, it continues to be impossible to have it analyzed and digested through reading. Experience shows, that in many cases the reasons why a potential drug failed in the late stage could have been found in the literature. Furthermore new promising targets could also be identified from literature, but the pieces of information that allow scientists to develop new ideas are mostly hidden in more than one publication. As it is unlikely that any reader has all pieces of information in context (as it was possible in the past with limited publications and journals), the missing link cannot be made and innovative ideas remain uncovered. *Text Analytics (TA)* can provide the users with tools that allow them to mine the scientific literature, preferably full text, and to develop an understanding on related articles, on hot topics, and on hidden knowledge. Although it is possible to find related articles by key word searching, in many cases this is not sufficient, as certain scientific findings are described in many different ways as terminology to describe scientific findings vary widely. Deep indexing from vendors is not available for most databases. By use of ontologies and linguistic methods, *TA* provides tools that allow this kind of knowledge discovery in unstructured text.

The function must provide a framework for text analytics. This includes software (commercial and/or open source tools) as well as the infrastructure (hardware for running the software, the queries and the storage of the information that is indexed and annotated for analyses). Systems that are developed by the function should preferably not be a solution for one scientist but for a larger community, as a one to many solution promises higher return on investment. Another task of the function is mining the textual content of the web in addition to proprietary and licensed resources. For the latter, IA&VR has to take care that resources come with appropriate rights.

As *Text Analytics* is the function that is most closely involved in the discovery of new druggable targets, this knowledge should be a part of the company's "core competency" and outsourcing is not an option. However, software development as well as the necessary software adjustment could be outsourced, resulting probably in better quality. Coordination of the (internal and/or external) development of ontologies and taxonomies (not the infrastructure for developing and maintaining them) should be done in-house, although it may be possible to purchase or import commercially available taxonomies and ontologies if they exist and are deemed appropriate for the purpose.

9. Knowledge Discovery

Similar to the growth of unstructured textual information there is an even stronger growth of structured database information. These data reside mostly within a pharmaceutical company, although with the growing number of external cooperations there is an increasing need to share data in extranets and to mine simultaneously external databases. Within an ICIC, *Knowledge Discovery (KD)* is not limited to knowledge discovery in databases only, although this is the most important part. Furthermore, company knowledge resides not only in research data but also in other systems, where tacit knowledge could be retrieved directly and indirectly, e.g. SharePoint documents, internal travel, conference and business reports as well as blogs and wikis.

The function needs to provide a framework for data mining, including preparation of data as well as analysis of mining results, interacting closely with the owners of the many internal heterogeneous databases. Thus, *KD* –

together with *Information Management* – would deal with tools that optimize database access, i.e. searching, browsing, organizing, analyzing and reporting scientific information from internal and external information sources through existing workflow and discovery tools. In the chemical space for example, *KD* would provide tools that allow name-to-structure or structure-to-name conversions. Last but not least, providing visualization tools could be another task of this function. Because there is a strong open source community in this field of information science, particular attention and special commitments should be taken to any alliances and external cooperations, especially in a pre-competitive environment.

IN this field outsourcing is possible for any software development as well as the development of applications, thus enabling the *KD* staff to focus on the understanding of business needs and internal business processes and contributing to external cooperation and alliances.

Information Research Staff Skill Sets

As with *Information Access*, staff needs to have a background or long term experience in information science and/or information management. However, in *Information Research* it is more important to have an in-depth scientific (chemistry, biology, biochemistry, biotechnology or biopharmaceutics, medicine or linguistics, semantic search and retrieval) or business (marketing, business development, intelligence) background, preferably complemented by additional expertise in information science but this is not essential as the latter can be achieved by training on the job. Industry expertise in an R&D driven business is, however, required for most staff positions.

Staff dealing with AT activities needs to fully understand the business needs of their customer groups and – even more important – need excellent communication and presentation skills. For developing training materials they would also require excellent writing skills. *IC* needs scientists with a proven expertise in their research field and a strong interest in information science. They need to be able to understand the clients' complex scientific problems, to translate them into search queries and to determine the appropriate information resource. *IC* staff needs to have a deep knowledge of all business-critical resources. For IR&A, expert knowledge on information resources within one or more dedicated business area (e.g. therapeutic area) is mandatory as well as expert search skills in searching and analyzing plus a deep understanding of the corporation's business. *NI* staff need a particular expertise in information resources related to news and media, expertise in searching and analyzing news information, but especially a deep business understanding of the company, its products, markets, etc.

Both the *TA* and the *KD* function should consist of information scientists, computational linguists with a particular expertise in text mining, information retrieval, taxonomies and ontologies or a background in bioinformatics. They need to be at the cutting edge of information science as well as informatics, as this is still an evolving field and out-of-the box tools are not available or not sufficient. Additionally, they need to have a deep understanding of the scientific field to which text analytics is applied. For *KD*, there must be a strong focus on knowledge organization, data mining and visualization expertise.

III. Information Technology

Today's ICIC can only be successful and maximize the return on investment of each spent Dollar or Euro when a state-of-the-art information architecture is supporting their solution and services and allows precise integration in the workflow of the knowledge workers. Thus, these two core elements are service functions for the ICIC rather than ICIC clients. However, all ICIC clients eventually benefit from the solutions that are implemented.

10. Technical Information Management

A corporation's ability to manage and use information effectively is a key factor in determining how well it can deal with complexity. *Information Management (IM)* is dealing with the handling of both external and internal information, integration and exchange of information from a large number of disparate information systems that are usually within a corporation, and defines strategies for IM.

The function should provide a framework for IM, both in a technical approach (together with colleagues from IT) and by defining processes and workflows for data and information that are most effective and efficient. *IM* would also provide corporate-wide definitions and values (list of values), taxonomies and ontologies that allow the retrieval of information even when multiple classification systems are present. In addition, *IM* could also be responsible for designing information management systems that allow end users to seamlessly access and work with all information resources provided and licensed by the ICIC. In this approach, the conceptual design of, e.g. full-text linking services, document delivery systems, e-resources systems, rights management systems, and federated searches, in combination with role-based personalization of services, would also fall under this function – in close cooperation with IT.

Information Management itself should reside in-house as it has very strategic components. However, any software and application development could be outsourced and commercial solutions are often preferable. As with *Knowledge Management*, *IM* requires a corporate culture of information “sharing” in order to be successful. Without this, the best hardware and software alone cannot provide a good solution.

11. Information Technology & Informatics

The ICIC relies upon the smooth functioning of its information services and the availability of published content for its clients in the form of an eLibrary or Information Portal. *Information Technology & Informatics (ITI)* is also required to proactively drive technology improvements to enhance the way structured, and especially unstructured information, is retrieved and re-used within the organization. Recently, this includes being ready for mobile devices, especially now that eBook readers as well as the iPad are becoming more accessible in the corporate environment.

This function would typically own the support of a number of IT solutions required to operate the ICIC's products and services. It would include technology to seamlessly link to publishers sites; problem resolution service and small enhancements service as well as a project capability for the larger changes required as new technology becomes available and upgrades prove necessary. Additionally, the *ITI* would be able to recommend new technology and devices through pilot programs.

This service can be provided via a combination of different models, in-house outsourced or vendor provided. However, it is important that this unit is continually thinking about improvements and keep the ICIC on the cutting edge of new technology.

Information Technology Staff Skill Sets

The *Information Technology* pillar of the ICIC needs broad information technology expertise. In contrast to other IT staff they can not focus on a particular system, software or programming language. *TIM* and *ITI* staff needs to have up-to-date information solutions expertise, systems expertise and programming skills. They need to be eager to deal with new technologies and have strategic thinking. They need to have a deep understanding of the information workflow as well as retrieval expertise. Staff that support Information Retrieval need to understand both structured and unstructured data – how to retrieve it for re-use by business analysts and project managers. As information science is an area of flux and change, the IT staff needs to maintain a strong and dedicated interest in new and evolving technologies rather than just maintaining systems.

IV. Knowledge Management

The three pillars discussed as far, *Information Access*, *Information Research* and *Information* lead when interconnected and fully utilized, into an indispensable and business critical function that could be also described with the broader term Knowledge Management. The authors have extensively discussed if *Knowledge Management* is really a twelfth core element or rather a spirit that characterizes the ICIC. There is a general agreement that Knowledge Management does not necessarily need to be an organizational unit – KM needs to be a concept, an attitude lived by the entire ICIC. However, as some services are core elements in the general expression knowledge management, a core function *Knowledge Management Services* has been added as twelfth element. Consequently altogether the 12 core elements unifies in the acronym **IART** (**Information Access, Research and Technology**) equalling to Knowledge Management (KM):

$$\mathbf{iART = KM}$$

12. Knowledge Management Services

The success of a pharmaceutical company is based on knowledge. Knowledge on druggable targets, on how to develop and optimize a compound for first clinical trials, or on how to conduct the clinical development until submission. Knowledge is still important when a drug finally successfully treats a disease. Thus, it is crucial to organize and integrate internal (tacit or explicit) and external (published) knowledge in a way that simplifies access.

The definition of *Knowledge Management (KM)* and what it involves varies widely. Many definitions include what has been covered under *Information Management*. Here, *KM* is defined as a *concept* that involves bringing together the disparate sources of knowledge. Whether being tacit or being explicit the concept is to bring them together so that they can be stored, used, and understood together, either to establish the total knowledge bank of the organization, or to generate new information or missing knowledge, or at least make them apparent in the original building blocks. Subsequently, Knowledge Management Services (*KMS*) must offer information tools such as indexing, searching, linking, tagging and authoring tools. Expertise locator systems, wikis for knowledge sharing, conference reports or the tagging of published articles and internal reports to indicate value or comment with personal interpretation are all examples of KM directly linked to traditional corporate information centers' activities. In summary, the ICIC is an ideal manager of KM, being a trusted and recognized resource for information expertise.

A major part of the success of KM is cultural. To encourage staff to enter their information into a common resource, in order to share or to be used more generally in the organization, requires trust, benefit, and support. These are all attributes that the ICIC can and does deliver. Thus, *KM* itself should reside in the corporation. However, development and implementation of any tool or infrastructure that facilitates or promotes knowledge management might be outsourced.

Knowledge Management Staff Skill Sets

KM staff needs to be aware of cutting edge developments, applicable to the pharmaceutical industry. The function needs to consist of individuals that can cover both technical and cultural aspects, and also need to be familiar with business processes in the company which pertain to information and knowledge generation.

The ICIC within the corporation

1. Reporting line of the ICIC

The pharmaceutical industry is often stated to be an information industry. Pharmaceutical R&D would not be possible without access to external information; yet the ICIC can be seen in varying, and more or less logical places in the corporate infrastructure. Today, the majority (60%) of pharmaceutical information centers report into the R&D function, of the rest some 20% report into IT, and 20% report to other “corporate services” – with frequent changes. The general background for reporting into R&D is the concentration of the customers in this area and that researcher appreciate that success in R&D depends on access to cutting edge information services. It is easy to prove the value of the service, for example, to a research chemist synthesizing new chemical entities – because information is as vital to him as electricity or his reagents – he cannot work without it. Where ICIC is servicing the entire company, for instance also Sales and Marketing (where information is also vital), prioritising needs and budget demands becomes an issue.

This is a disadvantage of reporting into any specific part of the corporate structure when serving the whole company. Logically it should be ideal to report into a corporate function serving the whole company. About a fifth of information centers report into the IT function in the organization. IT serves the whole company and has become a vital part of the infrastructure similar to the information center; however this is where the similarity ends.

The big disadvantage of reporting into IT is that technology takes over, and the information management part for the services seems to become hardware and software management rather than concentration on generating innovation through the combination of information and knowledge. Both services have “information” in their names, both the IT department and the information center claim information management as one of their core skills, however their definition of what information management means differs greatly.

The corporate-wide nature of the information service should call for advantages in reporting with other corporate services, as do 20% of information centers in the P-D-R. The issue here is that whilst these are serving the whole company they may well be seen as being an overhead with little understanding of their value.

There is little doubt, that ideal reporting line would be to the highest possible level reflecting the cross-organisational value of information in a R&D driven organization. Ideally reporting should be to a board level Chief Information Officer who understands all aspects of information management, but otherwise into the part of the organization, where information as competitive key asset is best understood, and R&D seems to be where this is best combined.

2. Organizational model of the ICIC

There are many ways to organize the twelve core elements (fig. 1) of which an ICIC should consist. These twelve elements are just a description of what needs to be done in an ICIC. There are several possible models that combine these functions. However, it seems important that an ICIC is a centralized function to which all functions report or at least a coordinating function which ensures that the matrix organization works well. Thus, the twelve building blocks could be departments or groups within the ICIC. Depending on the size of the corporation, some building blocks could and should be merged. As information science is one of the most developing and changing professions, and the ICIC is far away from managing business processes that stay similar over years, it would clearly be an advantage if the ICIC is a flexible and agile organization.

Table 1 below shows the degree of interaction between the twelve building blocks. Depending on the degree of interactions and, subsequently, overlap of skill sets, some building blocks could also be aligned, especially in smaller corporations, where specialization is less possible.

Table 1: Degree of interaction between the twelve core elements of an ICIC.

Dependencies and Interactions Between the 12 Core Functions +++ highest degree of interaction	1. Information Acquisition & VR	2. Information & Library Services		4. Awareness & Training	5. Information Consulting	6. Information Retrieval & Analysis	7. News Intelligence	8. Text Analytics	9. Knowledge Discovery	10. Technical Information Management	11. Information Support, Informatics & IT	12. Knowledge Management Services
			3. Community Management									
1. Information Acquisition & Vendor Relations												
2. Information & Library Services	++											
3. Community Management	++	++										
4. Awareness & Training	++	+	++									
5. Information Consulting	+++	+++	++	+++								
6. Information Retrieval & Analysis	+++	+++	+	++	+++							
7. News Intelligence	+++	++	+	+	+	+++						
8. Text Analytics	++	+	+	++	+++	+++	++					
9. Knowledge Discovery	+	+	+	+	++	+	+	+++				
10. Technical Information Management	+	+++	+	+	+	+	++	++	+++			
11. Information Support, Informatics & IT	+	+++	-	+	+	++	+	+++	+++	+++		
12. Knowledge Management Services	+	+	+	+	+	+	+	+++	+++	+++	+++	

Information Management, Information & Library Services and Information Technology & Informatics could, especially, in smaller corporations, be aligned into one unit. *Information & Library Services* has as a potential overlap with the *Information Consulting* function, another cornerstone, whereas *Awareness & Training* has one with the latter. Therefore, responsibilities need to be clearly defined. In smaller companies and companies with limited FTE resources these tasks may be done by the same ICIC staff members. *Information Consulting* itself has also many strong dependencies and overlaps with several ICIC functions, thus clearly indicating that it is another cornerstone within an ICIC. The particular expertise of Information Consultants regarding the value of information resources is of high interest for the function *Information Acquisition & Vendor Relations*. There is a natural overlap with *Expert Searches, Information Retrieval & Analysis* in terms of professional searching so responsibilities must be clearly defined.

Text Analytics is crucially dependent on *Information Acquisition*, and have an overlap with *Knowledge Discovery*, as well as *Information Consulting* and *Information Retrieval & Analyses*. Thus, *Text Analytics* is one of the functions that should be strongly embedded in the ICIC organization.

The organization model finally also depends on the number of FTEs. The recommended staff count may depend on the number of employees in the corporation, especially in R&D.

3. How can ICIC budgets be set?

All too often library acquisition budgets have been based on a historical perspective and often based on previous print collections. Budgets have been inflated by “industry standard“ annual inflation, in addition to what publishers see justified due to the ever-increasing amount of research being published. Information centers are often seen by non-scientific management as being an overhead and therefore subject to cuts.

All departments need information in their work processes, as much as they need IT services, chemicals, and a basic work place, so generally the ideal way of budgeting is to take the cost centrally with no back or cross

charging at the level of individuals or teams. This secures that information will not be missed because it is too expensive, however it is equally important to visualize the cost of information for the departments and individuals who do not pay directly for it. The impression that information is free is widespread. Every manager of a CIC must have heard users saying, „Isn't this free on the internet“ ignorant of the fact that the only reason they can access the information is that the library has licensed it.

Number of employees plays an important role in budgeting. The pricing of some information resources is directly based on the number of employees. Usage based pricing is also a parameter in the many pay-per-view based solutions available, and hence the number of active users very often sets the price. Budgets should take employee numbers into considerations, as it is such a strong indicator. Sharing/charge back of costs across the corporation is also often done on the basis of employee numbers, and if combined with usage it makes sense, but adds to the administration costs. .

Another way of assessing an information budget would be as a percentage of total spend, or spend on R&D, but it does not take into account the different needs of different corporations and calls for a clear cut benchmarking across the industry. In a cross organisational CIC the priorities also become a problem, if R&D budget is going to be cut. This would then automatically result in a limited information resources portfolio for all other functions that are not R&D. Thus, having general funding by all user groups from a high level is seen as being most effective.

The opposite extreme to having a centrally funded resource is to organize for information suppliers to charge the departments directly on a per-use-basis. This would require that each area of the company has individual accounts with information suppliers, whilst the overall deal would be negotiated and managed by the ICIC. Whilst making apparent the cost of information to users, this method would introduce an overhead to the supplier due to the multiplicity of accounts, making information more expensive and to the ICIC in helping to set up and manage the accounts.

A full charge back model would be to have single accounts with information suppliers but for the ICIC to administer an internal cross charging system for departmental usage including overheads for staff functions. This has the disadvantages of being an extreme administrative burden on the ICIC whilst shifting the focus of negotiations away from vendors towards internal bargaining between departments which is not the most effective use of time.

In summary, the „Ideal Corporate Information Center“ should have a fixed budget based on a clear information strategy, and a thorough concurrent audit / assessment process of the changing needs of the corporation and the development of the information industry. This budget should be used to purchase information in the most cost efficient way, deliver core services adding key value to this, and report overall performance on this with key performance indicators to key stakeholders.

4. The question of the physical space

With the disappearance of the classical library there is declining need for physical space shelving the acquired information. Nevertheless, there still needs to be a space that hosts the ICIC staff and that has preferably meeting rooms and presentation rooms for awareness and training activities. If this space is situated in the center of the campus, or close to the cafeteria, it could also host a small collection of up-to-date printed material. If the building is designed as a “knowledge center”, the space could be used as an informal exchange place with customers, like e.g. the ”Genius Bar” at Apple Stores. Although information professionals would mostly work remotely with their clients it would give them more visibility. Furthermore there is a need to be able to visualize the virtual data collection, in a physical space, which can be central, embedded in meeting rooms, innovative

spaces, or wherever needed, a visualization which is based on newest hardware and software technologies developing touch screen based information sharing environments.

5. Benefit of a Corporate Information Center

Harvard University Chemistry Professor Frank Westheimer's discovery "A month in the laboratory can often save an hour in the library" – the tongue-in-cheek saying – is even truer in this era of the virtual library. The cost of not having access to information for a research-based company can not be measured. Take the case of a chemist given a molecule to synthesize without access to the literature. A capable chemist (capable only because he reads the current literature) may be able to suggest 2 to 3 possible synthetic pathways to the molecule – may even be able to guess the best one, but then would need to run many experiments to decide on the optimum conditions for each step in the synthesis – information readily available in the literature. They would be reinventing the wheel continually. Pharmaceutical research is not possible without access to the published literature – it is invaluable! – so how do we put a value to it and decide on a budget for it?

There have been several attempts to calculate ROI, mostly by publishers [9–13] but storytelling is probably still the best way to prove the benefits of an ICIC.

Another way of considering the value is to estimate the cost in case no information being available, e.g. if a company is missing a paper reporting toxic effects which would – if known – result in the project ceasing or changing – even worse if the compound had made it to market and patients were suffering. Budgeting will always be a limiting factor for an information center, but we must guard against customers not getting the information they need because it is "too expensive". The cost of not getting it could be millions of dollars.

Every company manages information at some level, but the companies that outperform the competition are those that have developed mature information management capabilities.

Recent surveys both from pharmaceutical companies, vendors, and consultants show that the possible benefit of information is underutilized. The recent lack of new and innovative approaches and subsequently new drugs may be linked to non-efficient use of information and information tools.

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