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Hospital Facilities Programming: An Opportunity for Vanguard Medical Practices

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RESEARCH

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Abstract

Background
Facilities programming researches building users, including their organisation, activities, needs, and cultural patterns, with the purpose of developing design requirements and specifications. Programming is a tool for specifying building performance, quality, and user experience. The goal of this paper is to introduce best practice in hospital facilities programming

Method
The project is conceptualised as a benchmarking study. It employs a multiple case studies research design and utilises the principles of Grounded Theory. Trustworthiness and credibility of information are ensured with a number of techniques typical for qualitative research methodology.

Results
The programming process of advanced programming practices can be thought of as including four phases: planning and commencement, functional programming, space programming, and approval of the final document. Most of the innovation that occurs during the programming process happens at the phase of functional programming. Extensive strategic decision-making, organisational re-design and operations improvement are what set off best practices from ordinary providers.

Conclusion
Each new hospital facility development project provides an opportunity for hospital administrators and medical staff to create a better work environment, a better healing environment, and a more efficient and innovative organisation. Hospital professionals have important roles in the decision-making process, and through facilities programming, they can seize the opportunities that are available for participation, contribution, and empowerment.

Key Words
Facilities programming, briefing, facilities planning, facilities development, facilities design

Background

This article is about best practices in hospital facilities programming (briefing). The term "programming" is commonly used in the United States while the term "briefing" is usually used in the U.K. Facilities programming researches building users, including their organisation, and their activities, needs, and cultural patterns, with the purpose of developing design requirements and specifications. Programming is a tool for specifying building performance, building quality, and user experience.

Currently, hospital facilities present a number of challenges to designers because of their complexity, size, and technology, as well as the diversity of their user groups. Designers have to deal with the complexity of hospital operations, the particular requirements of healthcare work, and other special needs and code requirements. The commercialisation of healthcare and its tight profit margins require all available resources to be mobilised in order for hospitals to survive in a competitive world. In this environment, hospital administrators have turned their attention to improving each and every component of the healthcare delivery system, including hospital facilities and all aspects of built environment.

The literature on facilities programming is not prolific. With the exception of industrial facilities planning, it is not very common to publish on programming. The last collective monograph on programming was published in 1993.[1] A handful of monographs were published after that.[2, 3, 4, 5, 6] Journal articles are also not very common, considering occasional publications in the trade magazine *Facilities*. There are a number of publications that discuss issues and problems fundamental to programming.[7] However, there is certainly progress in the field of programming, driven partly by well-informed clients like

those in the healthcare industry and by hardworking experts in a number of facilities planning firms or departments of large design firms.

Most of the vanguard developments in facilities programming have emerged in hospital programming. There are a number of reasons for this. Hospital facilities and operations are so large, complex, and difficult to understand that a single designer cannot tackle all of their challenges. In everyday building types, architects develop personal experience and knowledge over the span of years; for the most part, hospitals are not visited frequently by designers, and thus they are less familiar. In addition, complex technologies and operating systems render hospitals closer to industrial facilities than to typical civic building types.

The healthcare industry is among the leaders in applying innovative approaches to building planning and design, including user-centred design, evidence-based design, and facilities programming. While in many other industries the development of design specifications is often overlooked, the healthcare industry has a long history of methodical planning of the hospital development process, as well as exceptional attention to the programming of facilities. Since the 1990's, this process has intensified and improved tremendously, leading to the establishment of advanced programming services within the framework of hospital facilities development.

The array of programming approaches that are used in hospital planning is quite wide. These approaches range from very advanced methodologies to traditional building type methods that can be enhanced with brainstorming and some forecasting techniques. In this respect, it is important to identify best practices in facilities programming and to communicate them to hospital administrators and senior medical staff.

Programming and the related pre-design activities make up the most significant stage of the process of preparing for productivity, efficiency, and output in the new facility. Hospital professionals will benefit from information about facilities planning technologies in the same way they might benefit from knowledge about new medical technology systems. In the current climate of tough competition, buildings have become one more component of the technological network of the hospitals, and as such they require attention comparable to all other healthcare technologies.

Method

The purpose of this article is to shed light on hospital facilities programming and to provide a general background that will help hospital administrators and senior medical staff to identify and include best practices in hospital facilities programming. The paper intends to introduce medical professionals to the most progressive programming methodologies as they relate to the facility's future work and productivity, as well as to the problems and issues that providers must consider when embarking on a new hospital development project.

The project presented here has been conceived as a benchmarking study. Benchmarking is a process of finding the best practices in a particular field and learning from them. Within the realm of professional improvement, what matters is quality of methods, rather than the most common and the customary ones. The emphasis is on best-in-class developments, from which programmers and clients can learn about advanced programming approaches and techniques. Numerical values, frequencies, and geographical distributions remain outside the scope of this project.

The research design of this project was carefully developed by referencing the work of Chris Argyris and his ideas regarding theory espoused versus theory in use.[8] Experts in organisational learning and reflective practice also recommend the use of case studies and qualitative methodology. Considering these suggestions, a multiple case study approach was adopted for this study. It was construed from the positions of Grounded Theory methodology with references to major principles of Symbolic Interactionism.

Information was collected primarily through in-depth interviews. The interviews employed interview guides with "grand-tour" questions and multiple probes.[9] Interviews were conducted in series and lasted from a couple of hours to 10-15 hours per case. In addition, document analysis was used for triangulation. Documents included programming reports, work plans and schedules, information-gathering tools, handbooks, and corporate standards, as well as dozens of other sources specific to each case. This study did not utilise direct observation; however, in this project, observation appears to be prohibitively expensive and intrusive.

Trustworthiness and credibility of information were procured through a number of methods and techniques typical for qualitative research. The researcher developed a methodological log, applied triangulation by method, and engaged in "thick descriptions." [10, 11, 12] In addition, peer debriefing and establishing referential adequacy was used. During the analysis and interpretation of the information, quality of data was assured by using structural corroboration, reflexivity, referential adequacy, member checks, an audit trail, and a dependability audit.[11]

The sampling for this study was theoretical.[10] It continued until theoretical saturation and included six cases. The project focused geographically on the Great Lakes Area in the U.S. There was a preliminary screening procedure for identifying eligible programming operations, and this included a number of criteria, such as reputation among peers and clients, recommendations from key experts in the field, programming philosophy, indicators for engaging in field research, and size of projects. After

selecting a programming firm, one of their programming projects was chosen according to the following criteria: it had to be a large, innovative hospital facility; clients provided support for the project, and this support included adequate resources and time limits; and programmers felt pride in an exemplary project that they consider a showcase for their practice.

This study was conceived as a benchmarking initiative, and for this reason the emphasis was on best-in-class examples rather than representative sampling. There are many good practices that were left outside the scope of this study. However, comparing the research results to existing publications, there are reasons to believe that the methodologies identified and discussed in this project are truly benchmarks in hospital planning and programming.

One approach to understanding advanced programming practices is to look at the process of programming, the scope of tasks, and the methods employed. For that purpose, programming cases were transcribed and presented step-by-step and analysed accordingly. Furthermore, a generalised model of advanced programming practices was developed and used for additional analysis and interpretation. Based on the principle of theoretical saturation, the generalised model was bolstered by different cases that were deemed important and informative, and that are expected to reoccur in many project situations.

Results

The programming process of advanced programming practices can be thought of in four phases: planning and commencement, functional programming, space programming, and approval of the final document. Each phase has different time length, resource requirements, function, and importance in the overall process (Table 1).

Table 1. Main phases of the programming process

	Programming Phases
1.	Planning and commencement of the project
2.	Functional programming
3	Space programming
4.	Approval of the final document

Phase 1: Planning and commencement of the project

Although planning is routine in hospital building projects, more sophisticated operations take the process further (Table 2).

Table 2. Phase One: Planning and commencement of the project

	Planning and commencement steps
1.	Reviewing of existing hospital business plans
2.	Exploring general directions with top decision-makers
3.	Deciding on engagement with strategic planning
4.	Meetings with stakeholders
5.	Surveying issues and problems
6.	Distributing departmental questionnaires
7.	Benchmarking visits

Clients usually have the opportunity to inspect the process planning documents at the time of proposal presentations. Clients need to take care in inspecting the scope of work and its time schedule. After the project is commissioned to a particular programming firm, clients should request and inspect a much more specific plan for action, including process management structures, a process monitoring system, and criteria for assessing the progress. The programming process involves a large number of stakeholder committees; it requires an extensive time investment by client employees and managers, as well as substantial resources to be devoted by the hospital organisation for programming itself, in addition to direct remuneration of the programming firm.

At the commencement of the project, programmers review business and master planning documents (which might already be obsolete), explore general directions with the top decision-makers, and decide how deep they will go to engage in strategic decision-making. Parallel to this, they begin a series of meetings and conduct surveys with the purpose of indentifying key issues, problems, and considerations that must be taken into account. Programmers also distribute departmental questionnaires for preliminary data collection and development of a database. At this time, benchmarking visits of similar facilities should be conducted.

Phase 2: Functional Programming

Functional programming is about envisioning the future of the organisation and redesigning the organisational structures and operations that will be accommodated by the new facility. In this process, an organisational design is developed with the consideration of financial resources and spatial possibilities. Functional programming is usually organised into two sub-phases: strategic decision-making and operations improvement (Table 3).

Table 3. Phase Two: Functional programming

	Sub-phases
1.	Sub-phase One: Strategic decision-making
2.	Sub-phase Two: Operations improvement

Although many programming operations follow this basic template, best-in-class practices differ in several ways. They employ experts in hospital management consulting and related specialties, and these experts have better training in organisational research and engage more deeply in organisational development. While most of the traditional programmers will take at face value existing documents, advanced programmers will question such data and will make their own inquiries. This is important because existing business plans might be obsolete; administrators might need assistance in re-envisioning their organisations; and in many cases, available information is about current organisations and operations instead of the future practices.

Functional programming activities might encompass all pre-design phases, from inception and feasibility studies to business planning, master planning, and organisational design, depending on what kind of previous documents

are currently available, and how reliable they are considered to be by the programming team.

Sub-Phase One: Strategic Decision-Making. The strategic decision-making sub-phase is crucial for the success of the hospital business because it determines the macro parameters of the new facility (Table 4). The work starts with defining/redefining the mission statement of the hospital. Another fundamental task is to determine the catchment area, the service population, and the target user groups. These decisions have a direct impact on the future discussion of types of services, service load, and facility capacity. At this time programmers might develop profiles of user groups in order to better understand their needs, preferences, and activity patterns.

Table 4. Sub-phase One: Strategic decision-making

	Strategic decision-making steps
1.	Defining the hospital mission statement
2.	Defining the hospital catchment area
3.	Defining the service population and user groups
4.	Defining the types of services and facility capacity
5.	Analysing the business environment
6.	Defining the business strategy and service mix
7.	Testing the feasibility of the project
8.	Clarifying management and operational philosophy
9.	Identifying the facility concept and organisational characteristics
10.	Translating workload into building capacity and budget
11.	Discussing and fine-tuning the project
12.	Gaining interim approval of organisational design

Good programming requires that the business environment to be analysed and defined correctly. On that basis, programmers will develop the business strategy and service mix. After this strategy is developed, programmers will relate the new facility to the larger healthcare system and then test the feasibility of the project in business terms.

The process involves discussions on operational and management philosophies and models. It is important to make clients aware of their mode of operation because it impacts future behaviour patterns and through them, the spatial parameters. At this time, there is enough information to prepare an initial concept of the new facility and define the most important organisational characteristics. Programmers may then invite top client decision-makers to discuss the project and to approve the organisational design.

The next steps, which are more concrete, focus on workload and facility capacity. Programmers must collect and analyse information about demographics, emergent trends, and projected needs. After that, using space drivers or standards, which are based upon published sources or experience, programmers translate workload and activity volume into building capacity while keeping in mind square footage and budget considerations. The budget estimation might continue from this point in even more detail, taking into consideration site and construction peculiarities, equipment, and even future operating expenses.

At this point, programmers need to have their interim proposal approved again in order to continue with operations improvement. If the projected budget and expenses during the life cycle of the building substantially exceed feasible investments and current financial resources, programmers may need to reconsider all previous decisions. The process is cyclical in nature.

Sub-Phase Two: Operations Improvement. Operations/ activities make up the content area that most closely relates to spatial issues. Operations and related activity patterns are later translated into spaces and design requirements (Table 5).

Table 5. Sub-phase Two: Operations improvement

	Operations improvement steps
1.	Organising departmental participatory structures
2.	Presenting the new organisational design
3.	Conducting departmental interviews
4.	Considering departmental mission and operations philosophy
5.	Relationships and integration with other departments
6.	Researching user groups at departmental level
7.	Redesigning departmental policies and procedures
8.	Projecting services and workload
9.	Considering operations improvement
10.	Considering spatial implications on operations and staffing
11.	Considering departmental reconfigurations and mergers
12.	Preparing the first draft of the functional program
13.	Preparing preliminary space and budget estimates
14.	Adjusting services, operations, and budget
15.	Discussing and preparing for approval of the draft
16.	Gaining approval of the functional program

This sub-phase starts with organising participatory structures and committees at the departmental level. Then all participants are briefed about the strategic decisions and persuaded to accept the new organisational strategy and plans. It is very common for programmers and key decision-makers to face stiff opposition regarding changes and new practices.

Meanwhile, programmers will have analysed the departmental surveys administered at the beginning of the project. Now they start follow-up interviews at the departmental level. The algorithm that has been guiding the strategic planning process is applied again to each department. Programmers guide the decision-making regarding departmental purpose and functions, projected trends, operations philosophy, scope and quality of services, and other functional components. In addition, there is careful consideration of relationships and integration with other departments and service programmes. Programmers continue to study user groups at a more concrete level, exploring values, preferences, and priorities. It is important to review and if necessary to redesign departmental policies and procedures. This can be a substantial endeavour, and it is typically once-in-a-lifetime experience for hospital professionals. Programmers continue with projections of workload for each service and procedure. After compiling this information and assisting or making corresponding decisions, departments and service programmes might be redesigned.

The process continues with operations improvement. This

is an important set of tasks because the organisation and management of operations require extensive financial resources. Increased productivity and personnel savings during the life cycle of the facility can be larger than the initial cost of the facility. At this stage, it is very common to consider spatial implications in relation to improving operations design and staffing. One of the big secrets of functional programming is that operations improvement often leads to departmental reconfiguration and mergers, and to the elimination of redundant positions. In principle, this makes the organisation leaner, more efficient, and more competitive on the market. However, several positions may be cut and people may need to search for new jobs.

At this time, there is enough material to prepare the first draft of the functional programme. It is accompanied by a very simple, preliminary space programme and budget, developed with the help of space and cost standards. If the rough cost estimate is too high, there might be a cycle of re-examination of all decisions, as decision-makers search for ways to cut service programmes and positions without compromising the mission and strategy. After completion, the functional programme has to be reviewed and signed by the top decision-makers.

Phase 3: Space Programming

Space programming is about developing a list of spaces and spatial requirements. Advanced programmers use the functional program as a foundation and translate it into space and design requirements. At the end of the process, there is enough information for a more precise facility budget. If necessary, the procedures might be repeated several times until an acceptable fit is achieved among all constitutive components (Table 6).

Table 6. Phase Three: Space Programming

	Space Programming steps
1.	Defining major functional blocks of space
2.	Defining relationships and adjacencies between blocks
3.	Evaluating functional capacity of component spaces
4.	Defining the size and number of spaces for each function
5.	Defining adjacencies and locations within each block
6.	Defining design features/design requirements for each space
7.	Aligning staffing patterns and spatial organisation
8.	Realigning functional and space program if necessary
9.	Preparing a first draft of the space program
10.	Realigning the space program with the budget
11.	Considering strategies for future expansion
12.	Developing design requirements for each space
13.	Discussing the full program draft with stakeholders
14.	Making changes as needed

The process starts by defining major functional blocks of space and their interconnections, based on the main types of operations. Later, these blocks will be detailed in terms of smaller spaces and the connections between them. Once the main spaces are defined, they have to be tested in terms of their functional capacity. This is a process of constant referencing to the functional programme and of considering options for additional operations reconfiguration in order to optimise the interface of function and space. Typical tasks are estimating the number of spaces and their size regarding each function; deciding the preferred room locations and adjacencies; and defining the most important design features. After the preliminary spatial structure of the facility emerges, programmers explore staffing patterns, which will change in this specific spatial configuration. In order to optimise staffing, programmers might engage in additional process reengineering, as well as a reconsideration of space segmentation, adjacencies, and locations.

Now programmers can prepare the first draft of the space programme. After that, they may continue aligning spatial needs with the facility budget. If there are significant discrepancies, programmers may have to start a new cycle of adjustments. Meanwhile, it is important to explore strategies for future spatial expansion that may have to occur if business grows more than predicted. Programmers consider both architectural and organisational design means. Once these issues are decided, space programming continues with a comprehensive definition of the design features and design requirements for each type of space.

The full programme draft is offered for discussions by committees and stakeholder groups. If necessary, the cycle can continue at least one more time, ensuring that all facets of the hospital facility work optimally together.

Phase 4: Approval of the final document

The approval of the final document marks the conclusion of the programming process. Document approval can be structured in several steps, and these can vary depending on how the institutional chain of command is organised. The final programming document is first discussed and approved by participating task forces and committees. Then it is forwarded for approval by the chief executive officer. After that it is submitted to the board of directors. With the approval of the programming document, the hospital administration takes important responsibility regarding the quality of the design program and the future hospital facility. Administrators need to be very cautious and careful in this process.

Discussion

The benchmarked hospital programming projects and practices provide information about the nature of programming in this industry. The study highlights a number of topics and issues that, although already known, need much stronger emphasis and promotion in order to prepare hospital administrators and medical staff to take a reasonable ownership of the process and decision-making.

Most of the innovations happen in the process of making organisational design decisions, especially during the phase of functional programming. A high-quality organisational design forms a sound basis for subsequent spatial decisions. Clients should be prepared and should participate actively in organisational design. They have

the most expertise in their own organisation and operations, and because of this, the programming process depends upon their keen insights.

The extensive involvement in strategic decision-making, organisational re-design and operations improvement differentiate best practices from ordinary providers. Furthermore, advanced programming operations engage in cyclical adjustment of needs, requirements, and resources until the best solution is reached.

An analysis of the programming tasks indicates that most of the decisions are intertwined and require cyclical adjustments in order to come to an optimal solution. The best opportunity for optimisation emerges when organisational development and spatial issues are considered in relation to one another. This forces all participants in the process to engage profoundly with organisational development and to look at space as a catalyst for supporting organisational structures, processes, and operations in order to achieve higher levels of productivity and customer satisfaction.

Space definition and functional considerations are more closely related than any layperson might think. Many spatial decisions are actually functional decisions because of the reciprocal effect they would have on organisational operations and efficiency. Operational and space issues fuse into holistic sociospatial patterns. The programming team should include experts that can see these sociospatial situations from both sides.

The starting point of the core programming procedure is difficult to define due to extensive interrelationships and overlapping of business and space planning decision-making. At the beginning of the process, programmers must review all previous business and management plans in order to start from a steady foundation. However, in many cases these plans are obsolete and require considerable updates. This creates complexity for programming. After having started the programming project, clients do not have time to search for a management consulting firm that will engage in business planning and organisational design. This creates a niche, an opportunity, and a challenge for the programming team. Having learned from a multitude of such situations, programmers sharpen their skills in management consulting so that they are prepared to fill the void.

In this regard, there are several types of providers for programming services. One option is when hospital planning firms seize the opportunity to engage in programming. For them, this is a natural extension of their repertoire, considering that they are experts on the most important topics. A similar path is followed by the management consulting departments of the largest accounting firms. And a third avenue is when classic facilities planning firms see that they cannot stay competitive without stepping in to cover management consulting and organisational design issues. In all cases, the complexity of the situation is solved by interdisciplinary teams that include both management and design experts. With time, both parties learn from one another and acquire expertise in the realm of the other collaborating professions on the team. It should be mentioned here that the large architecture firms try to keep pace with this trend by either developing their own programming departments or subcontracting planning firms to fill in the void in management expertise.

It appears that a specialty that initially has been developed by architects in the format of client briefings or building-type analysis has gradually evolved to expand far beyond usual spatial design decision-making. This evolution emerged in a very natural way after clients started perceiving buildings, just like medical technology, as vital components of a sociotechnical system for delivery of high quality, patient-centred healthcare. The competition in the healthcare industry forced hospital operators to improve every bit of the system in order to stay viable and competitive on the market.

Conclusions

Facilities programming is an important process through which the most significant decisions are made regarding the future hospital organisation, the built environment, the workplace, patient conveniences, and, in the long run, professional satisfaction. Hospital professionals can seize the opportunity to participate in this process in numerous committees, information delivery positions, and decision-making situations.

Hospital administrators and senior medical staff can look at each facility replacement situation as an opportunity to create a better working environment for their personnel, a better healing environment for their patients, and a more efficient and innovative organisation that can offer better compensation while retaining better healthcare providers. Within the context of the programming practices discussed here, hospital professionals can see opportunities for empowerment, participation, and contribution. They have an important role in the information collection and decision-making tasks. They can function as concerned users, stakeholders, and experts. If the corporate decision-makers are well informed about best practices in facilities programming, they will contract better providers and will allocate more resources to support the programming process.

Programming is a vast and complex topic, bridging information and skills from multiple disciplines and professions. This short article is intended to raise awareness, to bring attention to an important trend and opportunity, and to engage hospital professionals in further explorations and considerations. Considering the trend of evidence-based design, there is an expectation that the hospital industry will benefit from more studies like this one and will support future explorations and research on these topics. Beyond the limits of this study, there are many issues to research and discuss in the future, depending on funding sources, publication

opportunities, and the emergence of a dedicated facilities programming community.

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