

PRODUCT IDENTIFICATION, PARTNERSHIP FORMATION, AND PRICING STRATEGY: METHODS AND RESULTS FOR BUILDING ENERGY PERFORMANCE SOFTWARE

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Introduction

This paper focuses on the issues involved in the development of a software product/service from the prototype stage to a fully developed product. More specifically, it focuses on the methods by which product capabilities are defined, partnership opportunities are explored, complementary partnership resources are identified, economic feasibility is assessed, and pricing options are identified. The generic results that are derived from the application of these methods also will be presented. The paper is based on the authors' recent work for an organization that has built software prototypes for building energy use and is ready to develop commercial products for the marketplace.

The methods portion of the paper covers the overall approach to the problem, sample design and rationale, topics covered in discussions with potential business partners and customers, evaluation methodology for competing products, economic feasibility, types of data acquired, and methods of analysis. The results section of the paper covers strategies for product development, partnership, and pricing. Much of the work is confidential; the results are of a general form that is consistent with the confidential nature of the material.

The organization for which this work was performed is developing building life-cycle information systems to assure total building performance. The focus is on the processes of building design, construction and operation. To date several projects have been conducted to develop tools that address specific issues at various stages of the building life cycle. Among them are:

- Building Life-cycle Information Support System to create an information infrastructure for the exchange and archiving of data;
- Design Tools which assist building designers to optimize the size of energy-using equipment and total building energy consumption;
- Commissioning Information Tools that verify the as-built operation of the building;
- Performance Evaluation, Diagnostic and Tracking Tools that track building operation and performance, and provide diagnostics and appropriate actions when performance does not meet design goals.

The overall vision of the client is to create a comprehensive, integrated set of tools with seamless information flow between them. These tools will support all phases of a building's life cycle. Having made demonstrable progress, the project team wants to take the next step of forming partnerships with key organizations. The purposes of the partnerships are to secure continued funding, to obtain input and assistance from knowledgeable outside sources, and to realize the technologies developed as useful and marketable products.

Objectives

To assist them in realizing their long range vision for building performance assurance, we conducted this project to:

- Define the capabilities of three proposed products/services
- Evaluate existing product offerings
- Estimate economic feasibility of one product/service
- Identify the next steps to take
- Identify key business partners

The focus of these objectives is on topics that are fundamental to the formation of successful partnerships with outside organizations, and ultimately to the realization of the client's vision. Information about these topics will be necessary to develop and implement a business plan, which most probably will be required to secure partnership agreements with private sector organizations. Accordingly, the work in this project represents the first of several stages that must be undertaken in order to realize the commercial development and sale of many products/services in the marketplace.

Approach

The approach we used has several steps. We conducted a project initiation meeting with the client's project managers and selected staff to discuss and refine the issues we proposed to analyze. Based on the findings from this meeting and our review of the program accomplishments to date, we met with staff to obtain staff's view of product definitions for the three products that are the subject of the first part of this study - commissioning, performance tracking, and infrastructure tools.

We conducted two overview surveys - a telephone survey of potential business partners and customers for the three subject products, and a product literature survey of existing product offerings. We incorporated the product definitions obtained in the staff interviews into the interview guide for the telephone survey of potential partners and customers, and also into the evaluation criteria for the product literature survey.

We reviewed the results from the telephone survey of potential business partners and customers and from the product literature survey with the client's project management team. We concluded by mutual agreement that the performance tracking tool would be the focus of our work for the remainder of this project.

From this point we conducted three additional investigations:

- in-depth interviews with several potential business partners and customers of the performance tracking tool;
- an evaluation of selected existing products that will compete with, or are synergistic to the proposed performance tracking tool; and
- an economic feasibility assessment of the performance tracking tool in the marketplace.

We developed discussion guides that we used for the in-depth interviews. The product capabilities referred to in this guide were further refined based on the telephone survey that was conducted with potential business partners and customers. The respondents were selected from the group interviewed in the more broadly based telephone survey.

Concurrent with the in-depth interviews we evaluated in more detail selected existing products that will compete with, or are synergistic to the proposed performance tracking tool. The product evaluation criteria for these in-depth product evaluations also were revised to reflect the interim findings from the product literature survey. Finally, we assessed the economic feasibility of the performance tracking tool in the marketplace by conducting a "back of the envelope" calculation of the potential revenues for this product.

Sample Design and Rationale

Staff

We conducted three group interviews with the staff most closely involved in the development of each tool. The selection of these staff members were based upon the recommendations of the client's project managers.

Potential Business Partners and Customers

Telephone Survey. We obtained a list of company names and individuals from the client's staff, and com-

bined this with a list of names from the consulting team's industry contacts. We added descriptors to the lists for company type, title of the individual, and informal notes, if any, from the source for each name. The company types are:

- automation software company;
- building owner;
- controls company;
- energy service company;
- engineering consultants;
- equipment manufacturer;
- government agency;
- other;
- property management company;
- research organization;
- software developer;
- utility.

We sorted by company type, and within type by company name, and within company name by the order in which to call each individual based on notes from the source and/or title of the individual. Initially, the sample consisted of seventy six individuals.

In-Depth Telephone Interviews. A number of candidates for the in-depth interviews were identified from the list of organizations interviewed during the more broadly based telephone survey. Their strengths and weaknesses in terms of the objectives of this task were discussed with our client, and ultimately four organizations were selected - a controls company, a U.S. government agency, an electric utility, and a property management company. The selection was based on the following factors:

- the expertise and interest in partnership that the respondents expressed during the more broadly based telephone survey;
- knowledge of the potential market and customers to be served by the product/service;
- funding potential;
- access to the markets to be served;
- expertise in the buildings sector;
- experience in software product development.

Interview Procedures

Staff

The staff were interviewed at the client's offices in groups organized by product. A discussion guide developed prior to the interviews was used to structure the discussions.

Potential Business Partners and Customers

Telephone Survey. The individuals in the sample were called until a sufficient number of responses were completed to proceed with the remaining tasks in the project. As we began contacting the individuals in the sample, they recommended others to whom we might wish to speak. This resulted in an increase of the sample size to ninety one. Only in rare cases did we contact more than one individual per company at a time. This approach was followed in order to hear points of view from as many different organizations as possible.

Eventually we called fifty one individuals in fifty seven organizations. Interviews were completed with individuals in all of the major companies that were targeted for coverage. Repeated attempts to contact individuals in the sample were made (approximately ten attempts per individual, and more in some cases) when telephone calls were not returned or when the individual was traveling. Often we were contacting company presidents, vice presidents, directors, and managers. This made the contacting process difficult. A number of individuals did not return calls and/or were away from their offices so frequently that it was not possible to arrange to interview them. We interviewed twenty seven individuals. Twenty six interviews were completed; one respondent decided not to complete the interview because the company used only their own software.

In-Depth Telephone Interviews. Each interviewee was sent an introductory letter prior to the interview. The letter contained statements about our client's interest in engaging in more in-depth discussions with them, the decision to focus on the performance tracking tool for the remainder of this project, and a general statement about the topics to be covered in the interview.

A discussion guide was prepared in advance of the interviews. The interviewees were contacted by telephone to schedule appointments for the interviews. Because of the length of the discussions, the interviews had to be scheduled in two sessions per person. The interviews were conducted by telephone.

Each interviewee was read the list of product capabilities that we are contemplating for the performance tracking tool. This list was based on the in-person interviews with staff and on the telephone interviews with the potential business partners and potential customers. The interviewees were told to assume that these capabilities are integrated in one application that also includes basic functions such as data acquisition, database management and report generation. They were then read the capabilities one at a time, and were also given our informal, qualitative and relative rating of cost and level of expertise required of the user. They were asked to rate each capability on a scale of 1 to 5 to indicate how important it is, and consequently how beneficial it is, to include that capability in a tool to meet users' needs for up to two to five years from now. A rating of one is very unimportant; a rating of five is very

important. They were also asked to state the type of user that they are assuming when they rate the importance of the capabilities. That is, to whom are they assuming the capabilities will have the benefits and therefore the importance rating that they assign to them.

The respondents were not asked to rate energy use tracking, data acquisition, and data storage and management because we regarded them as capabilities that are essential to a performance tracking tool. We mentioned them so that the respondents knew that they would be included. As we did so they rated them anyway and, as anticipated, placed them the highest on the scale provided.

Three interviews were completed. One respondent did not want to respond directly to the questions in the interview guide that we prepared, although he expressed a high degree of interest in entering into discussions about business partnership.

Topics Covered In Discussions

The objectives common to all the interviews were to refine the product definitions in terms of specific attributes, and to identify potential customers and how they would benefit from use of the products. Additional objectives of the telephone survey and in-depth telephone interviews were to gauge interest in partnership, and to obtain respondents' perception of market potential. The specific topics that we covered in each set of interviews are listed below.

Staff

- Product/Service Objective
- Customer Description
- Product Definition - analytic capabilities, relationships to other products (e.g. stand-alone or dependent on other products)
- Benefits - unique capabilities
- Technical Support Required - telephone, on-site, debugging, maintenance, business hours, twenty-four hours
- Output - content, display capabilities, media
- Technical Specifications - language, operating system, protocols, and requirements for hardware, storage, and memory
- Contacts

Potential Customers and Business Partners

Telephone Survey.

- Applications Used
- Product Definition - capabilities, compatibility
- Target Customer
- Benefits to the Customer
- Partnership - suggestions, respondent company's interest
- Forecast for Success - product choice, degree of optimism

In Depth Telephone Interviews.

- Qualitative and Relative Rankings of Key Product Capabilities
- Benefits Derived By Capability
- Market Potential - potential sales (number of units or percentage of the commercial buildings market)
- Product Price
- Potential Business Partners - match between product and respondent's company, type of participation offered
- Obstacles - suggestions for resolution
- Next Steps - partnership agreement, product development process

The majority of the information obtained from the interviews is qualitative - comments, assessments, descriptions of problems, etc. Several questions resulted in responses that could be quantified, such as respondent rating of product attributes, interest in participation, and choice of product that has the greatest chance of success. The information was analyzed issue by issue across respondents, sometimes with the aid of matrices in which the information was summarized, and sometimes in lists of comments about the issues. In the few cases where the information could be tabulated, quantitative results were presented.

Evaluation Methodology for Competing Products

Concurrent with the interviewing process we conducted an evaluation of competing products. We wanted to know which capabilities that we were considering for incorporation in a product offering already existed in the marketplace, and to what degree they fulfilled the functions that we contemplated.

To accomplish this, we developed a list of candidate vendors that we grouped according to the proposed products of our client. We assembled available information and demonstration diskettes from a subset of vendors that were representative of the existing offerings. We collected basic information about each vendor (company contact, product name and model number, type of organization, company size, industry). We used as evaluation criteria the proposed product attributes for the products that our client is developing. These were derived from our interviews with the staff. Use of the proposed attributes as evaluation criteria provided a comparison of existing products with the proposed products that highlighted whether and to what extent the proposed products were unique. The existing products were evaluated qualitatively with respect to each criterion (i.e. a product function or attribute such as data base management, graphics, report generation, etc.) and the degree to which that function or attribute is supported by the existing product (e.g. substantially, partially, limited, none).

To facilitate our analysis, we arrayed the information in matrices. A generalized form for one of the matrices is presented in Table 1 below.

Table 1. Qualitative Ratings By Product

Evaluation Criteria	Product 1	Product n
Commissioning		
Criterion 1		
Criterion n		
Performance Tracking		
Criterion 1		
Criterion n		
Infrastructure		
Criterion 1		
Criterion n		

Following this analysis, we developed a list of products that were ranked highest in their correspondence to the type of performance tracking product that we envisioned developing. From this list, we identified those products that were most synergistic with our client's technology and therefore were potential candidates for a partnership, and those that were likely to be significant competitors.

Three products were selected for in-depth study based on a preliminary assessment of business factors and ranking of their overall likelihood for success. Business information about the vendors was obtained for the selected products.

The selected products were evaluated to learn more about their capabilities relative to those of our client's product. The results of the business and technical evaluation were combined to form conclusions about each vendor's overall potential to bring a product to market, either as a synergistic partner or a competitor.

Economic Feasibility Assessment

The objective of the economic feasibility assessment was to assess the market opportunity for a performance tracking product. The market for a performance tracking product most likely will be a subset of the building management systems (BMS) front-end software market. The feasibility assessment was therefore based on the overall assumption that the current buildings automation front-end software market is both the model and a gauge of the potential for a performance tracking product. It was further assumed that a performance tracking product would never be a standalone product operating without a facility automation system (FAS) or a BMS. Performance tracking product features will either be bundled into an automation software front-end product from an existing or new vendor, or will be an add-on product that interfaces with a facility or energy management system.

A “back of the envelope” calculation of the potential revenues for a performance tracking product can be made by first estimating the maximum or ultimate market, and then by discounting it based on certain assumptions. For this study the potential was derived from the following formula.

Total annual product revenues =
Discounted Potential =
Maximum Potential x Demand Factor x Market Share

This provides an estimate of the total revenues per year that a product provider might expect to achieve in a mature market.

Maximum Potential

We assumed 1) that the performance tracking software market has evolved to an equivalent level of maturity as the FAS/BMS market, and 2) that every time a FAS/BMS system is sold a performance tracking product is sold with it, then the maximum potential for these products is the same as the current market for FAS/BMS front-end software. We also assumed that overall price is equal for the two products. We further assumed that performance tracking products will be offered in different versions for different sizes and types of buildings in much the same way as BMS front-end software is offered. The final assessment can be adjusted if other price assumptions need to be explored. Since we do not have values for FAS/BMS software in the primary market, i.e. that sold with the total control system, we needed to make assumptions about that portion of the total control system that is attributable to this software. Based on these assumptions, the maximum potential market for a performance tracking product was estimated given various values of the percentage of sales of complete control systems that can be attributed to the front end software component.

Discounted Potential

Since it is difficult to achieve the maximum potential for a product, estimates of the discounted potential is a more practical measure of the market potential. This is the market opportunity that reasonably can be expected. It can be estimated by application of discount factors to the maximum potential. The following two factors were used.

- **Demand For Performance Tracking:** This factor takes into account that a performance tracking product will not be used in all of the buildings for which an FAS/BMS might be applicable. It represents the estimated fraction of the applicable market that is likely to incorporate performance tracking functionality. It is the ratio of performance tracking sales to BMS front-end software sales. It is also a measure of the desirability and/or value that customers place on a prod-

uct. This is a difficult factor to estimate since data do not exist for new performance tracking products. It is therefore best presented as a variable so that various assumptions and judgments can be applied easily. One way to estimate demand is to assume that the penetration of facility/energy management systems in commercial buildings is an overall indication of the attractiveness of, or demand for, sophisticated software tools. (The respondents to the in-depth interviews were asked to estimate market potential in a variety of ways, but they were not able to make reliable estimates at this stage of product development.)

- **Market Share:** This factor discounts maximum potential for the market share that a single vendor is likely to capture. It is the market share for one provider of a performance tracking product. This factor is important since it is the resultant revenues that a single provider may realize that will drive that provider’s decision to form a partnership with a product developer.

As stated above, an estimate of the revenues that a single provider reasonably may expect to derive from sales of a performance tracking product results from multiplicative discounts of the maximum potential. An overall Discount Factor is defined as the product of the Demand Factor and Market Share. From estimates of these factors, potential revenues from a performance tracking product were estimated for various assumptions of discount factor and percentage of revenues derived from sales of control systems front-end software.

Product Development Strategy

According to some of the respondents interviewed for this project, BMS and FMS systems do not meet users needs because:

- They are not detailed enough.
- The information is not available in a timely enough fashion.
- The data visualization capabilities are inadequate. For example, the trend log of a variable over time often is the type of information presented. In contrast, the plot of a performance metric such as kilowatt hours per square foot with a baseline reference for equivalent operating conditions is more useful; it embodies an analysis that enables the user to conclude quickly whether or not a problem exists.

- The systems are bypassed because the building management staff do not have the expertise to use them.

Our recommendation is to develop initially a performance tracking tool with a relatively limited set of core capabilities while the vision of the fully developed tool is maintained. The latter can be realized in stages by release of additional capabilities in modules that result in more sophisticated versions over time. The module is distinguished from an upgrade in that each module will add a new capability to the set of core capabilities in the initial release. This approach will accommodate a market that may not be ready to use a tool that is very advanced. It also lowers the entry cost for new users. Finally, it permits users to choose the degree of sophistication in the tool that matches their needs and training.

We suggest that the capabilities that should be developed first are those that have the highest rankings of importance in the in-depth survey conducted for this project. This set can be modified, as needed, according to the product pricing strategy outlined below, and according to the results of a broad based customer survey of preferences for product capabilities. These capabilities should be incorporated within an easy-to-use, consistent person/machine interface that also can be used for applications that address additional phases of the building life cycle.

Product Pricing Strategy

Suggested prices range from a low of several hundred dollars to a high of \$100,000 or more, with many of the suggestions falling in the range of approximately five hundred to two thousand dollars.

In very high end pharmaceutical applications, several weeks of consulting work ranges from \$10,000 to \$50,000. Alternatively, a yearly software license in this type of application sells for \$25,000 to \$35,000. In rare cases for very large building projects in the several hundred million dollar range, a product that sells for several hundred thousand dollars could be attractive. Refinery plant design falls into this category.

Possible pricing options include:

- Charges per installation on one computer
- Charges per application
- Charge per building (product infrastructure)
- Subscription service rather than sale of a product. The service is treated as an expense; it is not part of the capital budget.
- Tiered charges for large scale and all other scale applications
- Consulting service charges for problem identification
- Solution implementation charges separate from problem identification

- Guaranteed a rate of return on investment
- Free software paired with sale of service contracts

Many respondents with whom we discussed price could not estimate the price realistically without having a finished product with very specific attributes on which to base the price. The actual price will depend on many factors, among which are:

- the set of capabilities that comprise the tool
- the target audience
- the capabilities of the competing tools
- the price of the competing tools
- the advantages of the client's tool over the competing tools.

Although it was not possible to arrive at a target price at this stage of product development, the approach to setting this price can be described.

First, a segmentation analysis is conducted in which percentages of the market (e.g. for profit, non-profit, government, built by speculative developers, owner-built, owner-occupied, institutional, etc.) are estimated. Second, a decision is made regarding which segments are potential customers, and which are not. A survey of customers is conducted in each building segment to find out which building segments are the most expensive to serve, i.e., what modules do they believe are most important? This enables the product vendor to consider price add-ons and discounts for different customer groups.

Following the segmentation analysis, several estimates must be made from the customers' perspective:

- the price the customer would pay for the client's product given its features and given the features of the other competing products
- the value of the special features that are in the client's product (e.g. how much will that feature save the customer?)
- the pay back period for the capability
- the expected life of the capability (The customer must realize the benefits of the capability before it becomes obsolete.)
- the support the customer expects
- the warranty the customer wants.

These estimates are difficult to quantify; in many cases they will be subjective estimates based on the best judgment at the time. A combination of the segmentation analysis and the above estimates permits one to rank the modules in terms of the costs to develop, and to rank the building types (i.e. the market segments) in order of the cost required to serve them. It is also necessary to estimate, probably subjectively, the urgency of the customers' need for the module and associated service. Establishment

of a target price then becomes a process of experimentation with the hypothetical interchange of the modules. This interchange affects the market segments to which the tool is best suited, and the cost of the overall product, until a product price is attained that is competitive and that still offers unique features.

Partnership Strategy

Partnership strategies depend on a variety of factors, among which are: the marketing strategy, e.g., small shrink-wrapped packages or sale to large institutions; the product being developed; the complementary nature of this product to the products and services offered by the potential partners; the phase of the building cycle addressed; the role that the client wants to play in the product cycle; the risks that the client is willing to assume; and the client's objectives vis a vis the product.

Partner's roles may include:

- design advice
- software development
- alpha and beta test sites
- financial investor
- product/service distributor
- product/service support

There are specific steps that each organization requires in order to form a partnership. They vary depending on the type of participation, whether or not prior agreements exist between the client and the organization in question, and the amounts of money involved.

A rigorous written business plan and an oral presentation based on it will be needed to form formal partnership agreements with private sector organizations. Less rigorous documentation will be needed at first to form partnerships with governmental and quasi-governmental organizations if these organizations do not contribute financially to the partnership. If they do contribute financially, approximately the same degree of rigor that is required for the private sector will be required for these organizations as well.

We concluded that for the product in question, companies that produce automation systems used in industrial process control and facility management are not candidates for strategic partners. We recommended that our client select candidates for partnerships who can contribute:

- Technologies (e.g. operating systems, communications protocols, data exchange standards, database standards, and application specific software)
- Building management expertise
- Software product development expertise
- Funding
- Testing support

- Market access
- Marketing, sales and product support.

From this point, the approach is to select a set of candidates for partnership, ascertain in detail the steps that they require to form a partnership agreement, proceed down the path of formalizing the relationships if all signs are promising, and select different candidates if they are not.

Summary

In the work that we conducted we addressed:

- the product/service to develop,
- the capabilities to include,
- an approach for changing the mix of core capabilities,
- the standards and technologies on which to build the product,
- the use by which the product/service is (and is not) likely to succeed commercially,
- the organizations with which to form partnerships, and
- the elements to include in a business plan, and
- the immediate actions required.

Taken together, this material provides the basis of a strategy for an organization to realize commercial products and services derived from the software that they develop.