Chapter 2
Call Tracking Technology Selection Model

Wilson Zehr, Abdussalam Alawini, Mousa Alharbi, and Mohamed Borgan

Abstract In this chapter we evaluate the selection of a call tracking feature for an existing marketing automation solution. This type of selection process has become much more complex over time based on the sheer volume of offerings available, different technical approaches to implementation, and service plans (features plus costs). In order to manage this complexity for decision making, we gathered a set of core requirements from the client, assembled a panel of experts to rank the importance of requirements, and then evaluated the potential solutions based on those criteria. The actual decision making methodology used in this study is the hierarchical decision model (HDM) testing two alternative methods for evaluating the expert criteria ranking. In this case, by focusing on client requirements, rather than specific technologies or implementation approaches, allows us to greatly simplify this complex decision making process in the absence of a more detailed technical analysis of every possible solution.

2.1 Introduction

This project was undertaken on behalf of Cendix (www.cendix.com) a company located in Lake Oswego, Oregon, that provides innovative web-to-print solutions. The primary focus of Cendix is to deliver "custom branded" online applications that

W. Zehr (✉)
Oregon State University, Corvallis, OR, USA
e-mail: wilson@cendix.com

A. Alawini • M. Borgan
Portland State University, Portland, OR, USA
e-mail: alawini@gmail.com; mohamedborgan@gmail.com

M. Alharbi
AramCo, Portland, OR, USA
e-mail: alharbmousa@gmail.com

T.U. Daim et al. (eds.), *Technology Development*, Innovation, Technology, and Knowledge Management, DOI 10.1007/978-3-319-05651-7_2,

automate the ordering, production, and tracking of direct mail campaigns and marketing materials. The target customers of Cendix are enterprise marketing organizations and commercial printers that offer solutions to enterprise marketing organizations.

The flag-ship product of Cendix is called the Channel Marketing Portal (CMP). The CMP is designed for organizations that sell through "channels" (e.g. distributors, dealers, franchisees …). The marketing organization posts all of their corporate approved templates for direct mail, collateral, advertising, logo items, and other marketing materials in their own branded portal. Then channel members can visit the portal, select corporate approved materials, personalize and approve them, and then route them for automated production and delivery. The system automatically tracks and reports production status (processed, printed, shipped/mailed), delivery details, and response rates giving a complete 360° view of any campaign/order at any point in time.

One important client of Cendix is a large national bank that has been in business for over 75 years. They focus primarily on mortgage loans originated through mortgage brokers located at 200+ branch offices across the United States. The bank requires that all direct mail campaigns are delivered through their CMP. In this case, the portal also serves an important role from a government compliance standpoint by making sure that all the marketing materials comply with government regulations. Non-compliant marketing materials/campaigns can result in fines, branch closure, or even loss of HUD certification.

The bank has instituted a standard process where every direct mail campaign (or marketing material) must be approved by the compliance department. Once approved, the piece is uploaded to the CMP where it is available for branches to use. As campaigns are launched the CMP keeps a complete audit trail of what is produced and delivered; as well as responses to campaigns.

In the current solution, when a direct mail campaign is sent out, the client has the option of including a PIN number on the direct mail piece. This unique PIN number is automatically generated by the system. When a client responds by telephone the Loan Officer enters the PIN number into an online screen (called Lead Tracker) that pulls up the customer record. The information captured by the Loan Officer is added to that record and the response is captured allowing the system to capture responses and report real-time response rates. A version of this offering that uses a PURL (self-service web page for clients) as the response vehicle along with the toll-free number is also available. The end result is an inexpensive and complete end-to-end lead tracking and compliance system that gives the bank a competitive edge (Fig. 2.1).

One additional need the bank has identified is the ability to track and record incoming calls for branches. This is important for at least two reasons. First, if a customer calls outside of normal business hours the branch still wants to capture that lead even if the customer does not leave a message—every lead costs the bank money to generate. Second, some of the branches would like call recordings for training and coaching purposes. In addition, capturing calls provides even richer level of detail for the compliance process. Cendix was asked to add this feature to the CMP (Fig. 2.2).

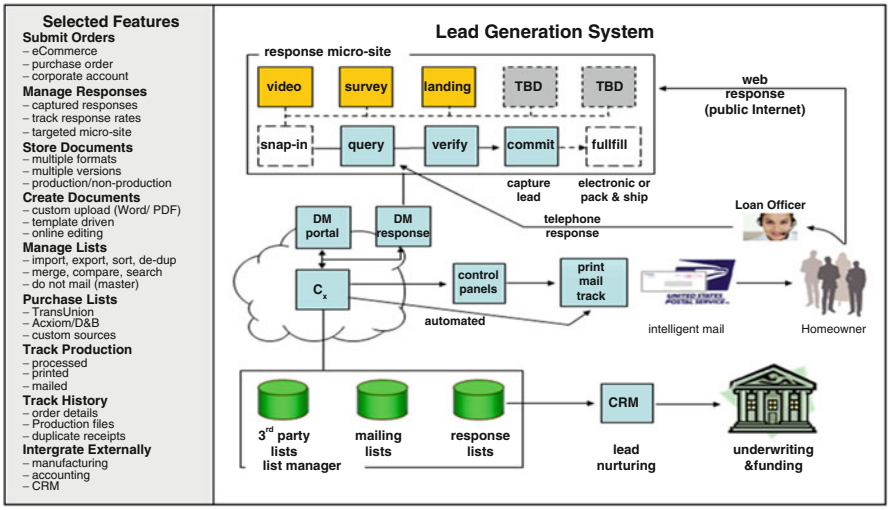


Fig. 2.1 Lead generation system schematic

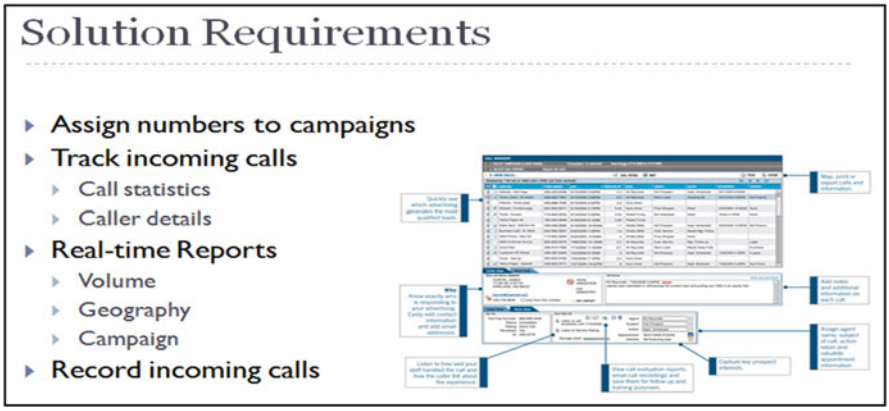


Fig. 2.2 Call tracking system requirements

The solution from a functional standpoint requires that calls are routed through a telephone switch which can capture call detail records (CDR) and (optionally) record calls. The call detail record will contain information such as the caller ID (name, number, and location), time of call, length of call, and disposition. With a connection to a demographic database a great deal of additional information can be generated about each caller as well. The information that is captured at this level can be displayed to users in a graphical form using pre-defined reports, graphs, or other standard reporting features. This information can either be displayed real-time with direct access to the switch or on a delayed basis if CDR's are batched and moved to other systems.

There are a couple of different ways to approach this problem from a technical standpoint. First, the client could elect to build a solution from scratch. There are telecommunications companies that own switches and provide API's so that vendors can write applications that pull CDR's directly from the switch. In this case the system would need to capture/store CDR's, create the software required to process and display call data, and manage user accounts/access. This type of solution would provide the greatest flexibility from a functionality and integration standpoint; however, it would require additional time to implement, generate additional engineering expense, and introduce delivery risk.

Second, it is possible to find solutions that already have the switch interface and data processing functions implemented. The basic platform could be used as a foundation to create an online application that would display call data and manage user accounts. This second option could be delivered sooner and provide complete flexibility with the features actually delivered to end-users. On the other hand, this solution would also require the expense associated with application development and take time to deliver to the market (although less on both fronts then the first approach).

Third, there are a number of existing solutions in the market that can be private-labeled—the switch integration and application development has already been done. The application just needs to be "private labeled" (e.g. customize the look and feel). The advantage of this solution is that very little, if any, additional engineering work/expense is required on the part of the client, the application can be live almost immediately, and there is no delivery risk. At the same time, this type of solution may include higher operating costs (to compensate the application provider), there is limited flexibility in the features and capabilities offered, and it becomes much easier for a competitor to imitate this solution.

The focus of this investigation is to select the right solution based on the capabilities of the offerings in the marketplace and the requirements dictated by the end-user client.

2.2 Methodology/Model Selection

The methodology selected for this analysis is the Hierarchical Decision Model (HDM). This tool initiates a decision process where both qualitative and quantitative judgments can be measured. It is based on the concept that humans are often less capable of making absolute judgments, and more capable of making relative judgments. This version of the model mitigates the difficulty of dealing with multiple criteria at the same time by using two different approaches: pair wise comparison and a simple scaled ranking based on expert judgment [10, 12, 13].

This model divides the different elements of the problem into smaller elements (sub-problems), so that the decision model is represented as a hierarchy. The simplest units start from the lowest level of the hierarchy, then the level of complexity elevates towards the final objective at the top of the model. A tree diagram can be

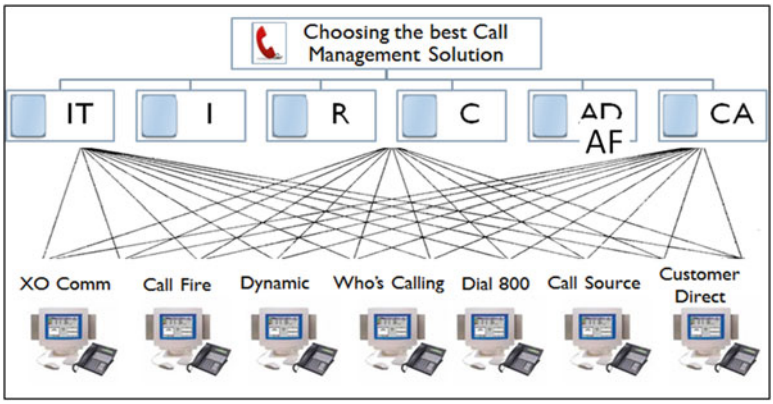


Fig. 2.3 Call tracking hierarchical decision model

used to represent the decision hierarchy; which is for this project is the goal, key criteria, and alternatives as illustrated in Fig. 2.3.

In the pair wise comparison analysis a set of experts use their knowledge and relative judgment to rank the importance of the decision criteria, using pairs of elements, and ranking those two elements in importance by splitting the value of 100 between them. So, in the case where two elements were equally important each element wars get a value of 50. On the other hand, if one element was extremely important, and the other was insignificant, then they might be ranked 90/10. The measurement results are captured as a collection of ratio judgments and used to generate a priority matrix. This process creates a set of weights for each individual element for each expert. We can then use the mean of these collective values to come up with an overall expert-based priority ranking for each criterion.

This mechanism creates a level of redundancy which can help reduce measurement error and bring a higher level of consistency to the results. The "implementation" of this process does not guarantee a high level of consistency, because it is very hard for an individual to be perfectly consistent across a wide array of comparisons by examining only two at a time, but it does provide an expected minimum level of consistency. When the results are outside those bounds then it allows us to explore the reasons for that behavior in more detail. High levels of inconsistency can be due to lack of adequate information, a low level of concentration, inappropriate model structure, or even errors in data values.

The other approach used in this analysis was to display all the values in a single list and allow the expert to assign a point value of 1–10 for each item. The total score for each expert is summed and then normalized scores are created by dividing the score for each element by the total. Since all the elements are on the same sheet, and evaluated at the same time, the expert can see and assign the relative value in the context of ALL the competing criteria. This visual analysis and reporting process can assure that there is no inconsistency on the part of evaluators and elements are ranked with a complete view of the "big picture" as well as the relationship between them.

2.3 Defining HDM Levels

2.3.1 First Level

Choose the best possible call tracking and management system based on the criteria provided by the client and the expert judgment of our panel.

2.3.2 Second Level

We performed a literature review and talked with industry experts to come up with an initial list of the most common criteria that would be used when selecting a call tracking system in this context. The result of this initial analysis was a list of eight criteria (not in priority order):

- Cost

  This element includes the cost of development and implementation; as well as the cost of operation and maintenance. There is often a trade-off between up-front cost and ongoing operating cost.

- Reliability

  This element considered the overall availability of the system and unplanned down-time. This can have a huge impact for mission critical systems; although unplanned downtime creates frustration on the part of users even when system failure is not catastrophic.

- Implementation Time

  On this vector we are considering time to market. We often have a market window to hit and the failure to meet our target can result in lost revenue, lost opportunity, and competitive risk.

- Contract Term

  Technology changes at a very rapid rate these days. Long-term contracts can lead to predictability and stability, but they can also expose us to market risk if technology or the state of the industry changes long before our agreement expires. Short-term contracts maximize our flexibility; at the same time, they can also leave us vulnerable when it comes time to renegotiate an extension if the solution is still optimal.

- Additional Features

  The customer provided an initial “minimum” list of features. These included the ability to allocate toll free numbers to accounts, track incoming calls for each number, capture and display the details for each call (including a name, geographic location, and callback number), provide a standard set of reports on volume and trends,

and (optionally) capture phone calls as WAV (audio) files. The system also has to provide a login for each account so that users can see only their own calls.

There are plenty of additional features beyond this in the market today. This element determines the importance of additional features above and beyond the customers' core requirements.

- Integration Potential

In general, the ability of tools to integrate and work well together improves the end-user experience and the overall utility of the solution. In addition, this element allows us to customize the tool and the features to create an optimal experience for each user or group of users.

- Compatibility

Compatibility allows us to work with existing and future applications. This can be especially important in environments where a great deal of investment has been made in legacy systems.

- Technology Flexibility

Flexibility on this front allows us to solve a wide range of problems based on a single investment in technology [7].

We proposed these eight criteria in our initial discussion with the client (Cendix). The client chose five of these features and insisted on another—Competitive Advantage. The idea with competitive advantage is that if an off-the-shelf system is used then competitors can easily duplicate the solution (e.g. there is a lack of competitive barriers). This was an important "strategic" concern in the mind of the client. Here are the final six criteria (not in priority order) selected by the client:

- Implementation Time (IT)
- Integration Potential (I)
- Reliability (R)
- Cost (C)
- Additional Features (AF)
- Competitive Advantage (CA)

2.3.3 Third Level

Vender Selection (alternatives): Once the decision criteria were established then the team considered service providers and solutions. The mandatory selection criteria were vendor reputation and financial stability [1]. The client also had an existing relationship with two vendors XO Communications and Integra Telecom so they requested that they be included in the evaluation. Plus, there is one industry veteran, Who's Calling that originally invented this market space/solution—no evaluation would be complete without including this latter offering.

Through an initial screen the team identified at least 32 vendors (Appendix) that fit the basic criteria—given more time we undoubtedly would have found even more

Table 2.1 Service provider/solution summary

Provider	Category	First-level screen
XO Communications	Switch provider/telecom	Yes
Call Fire	Switch provider	Yes
Dynamicic	Application provider	Yes
Who's Calling	Application provider	Yes
Dial 800	Application provider	Yes
Call Source	Application provider	Yes
Customer Direct	Application provider	Yes
Integra Telecom	Switch provider/telecom	No
Answer Connect	Call center	No
Call Experts	Call center	No
We Answer	Call center	No
ansafone.com	Call center	No

potential solutions. In consultation with the client the team decided to limit the number of solutions evaluated to 12 in order to have time to explore each in more detail. The team then created an RFI that was submitted to the three mandatory participants, several on the research list, and posted on BuyerZone.com online.

We created a short-list of 12 from the responses received. Then we screened these responses against the mandatory customer requirements which eliminated another five from consideration. This left us with a list of seven vendors/solutions for inclusion in the selection process. A summary of these providers can be found in Table 2.1 below.

When combined with the HDM this resulted in the following model for analysis.

2.4 Criteria Weights Assignment

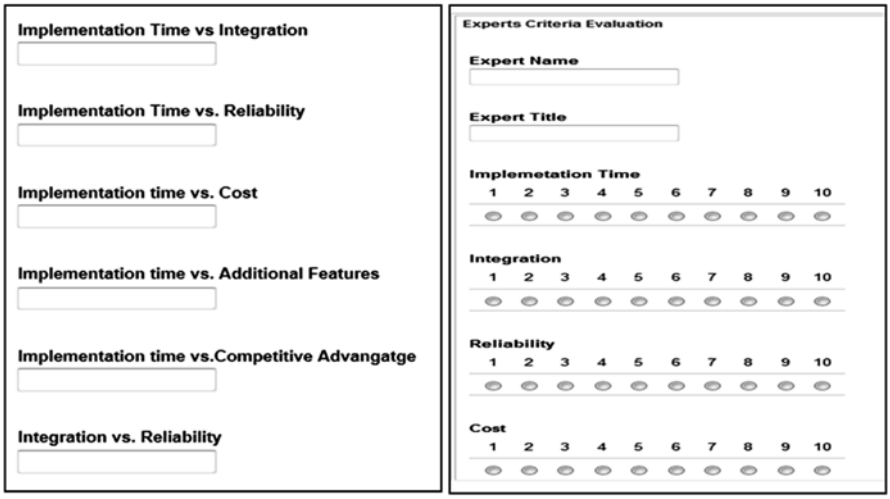
The expert panel will be used to assign the weights to each of the vendor criteria that will be evaluated. In this section, we will be first discussing the data gathering methods we've used to get expert inputs as well as discussing the application of the constant-sum method in assigning weights to the second level of our HDM model.

2.5 Pairwise and Scaled Ranking

We first considered using a simple scaled ranking methodology (described earlier) to capture the relative importance of each criterion and assign weights. However, we also appreciate the rigor and redundancy associated with the pair wise comparison method; as well as the ability to measure and assesses internal consistency. Thus, we chose to use and evaluate both methods for this project.

Pair-wise comparison, utilized in constant-sum method, is characterized by providing an accurate approach of measuring the internal inconsistency of each expert as well as the overall consistency of the HDM model [2]. One of the major limitations of pair-wise method is that when the number of criterion to be evaluated is large then the number of comparison will also be large and experts will face difficulties in maintaining a high degree of consistency. In addition, the process of conducting the pair-wise comparisons can also be time consuming [8].

The number of the criteria we have in our model is considered to be acceptable number for pair-wise comparison method. For the six criteria of our HDM model, each expert needs to conduct 15 comparisons which is still a manageable number for our experts.



Sample Pair Wise Survey Sample Scaled Ranking Survey

2.6 Pairwise Combined Experts Results

Reliability has the highest weight with 23 %. Cost comes in the second place with 22 % which is very close to reliability criterion. Competitive advantage, integration and implementation time are 18 %, 15 % and 14 % respectively. The lowest weight was for additional features at 9 %. Internal inconsistencies for all experts were below 0.016 which is considered to be an acceptable rate.

2.7 Scaled Ranking Combined Result

The scaled ranking evaluation was a much less time consuming process. The survey shown earlier was given to each of the experts on a web page. They were asked to rate each criteria on scale from 1 to 10 ranking the entire list at the same time.

Table 2.2 Scaled ranking survey results

	Normalized						
Expert	IT	I	R	C	AF	CA	Total
Wilson Zehr	0.20	0.13	0.18	0.25	0.08	0.18	1.00
Rajiv Agarwal	0.14	0.19	0.19	0.16	0.14	0.19	1.00
Jeff Belding	0.10	0.14	0.21	0.19	0.14	0.21	1.00
Ashok Bhatla	0.20	0.18	0.13	0.20	0.15	0.15	1.00
Abdussalam Alawini	0.16	0.16	0.20	0.20	0.11	0.18	1.00
Mark Walker	0.13	0.18	0.23	0.13	0.15	0.20	1.00
	0.15	0.16	0.19	0.19	0.13	0.18	1.00

Table 2.3 Comparison of pairwise and scaled results

Weighting approach	Implementation time	Integration	Reliability	Cost	Additional features	Competitive advantage
Pairwise—original	0.14	0.15	0.23	0.23	0.08	0.18
Pairwise—adjusted	0.14	0.15	0.23	0.22	0.09	0.18
Scaled	0.15	0.16	0.19	0.19	0.13	0.18
Scaled—Internal	0.17	0.16	0.18	0.21	0.11	0.18
Scaled—External	0.14	0.16	0.19	0.18	0.14	0.19
Scaled—Wilson	0.20	0.13	0.18	0.25	0.08	0.18

These results were then normalized by the expert score for each criterion by the sum of their scores. Using this technique there is no internal inconsistency because the experts rank all of the criteria at the same time. The experts can actually see the macro level relationship between the criteria before submitting them. These results are summarized in Table 2.2.

These results indicate that the consensus among our experts, using this scaled ranking technique, tells us that cost and reliability are the two most important facts at 19 % each; this is followed closely by competitive advantage at 18 %; and integration at 16 %. The last two criteria, implementation time and additional features trail the pack with 15 % and 13 % respectively.

These results can be compared with the Pairwise results generated earlier (Table 2.3). We can see that the weights and ranks are consistent with the earlier analysis, with reliability and cost coming out on top with just about equal weights; although the weights are higher in the pairwise analysis then in the scaled analysis, and reliability pulls slightly ahead in the adjusted (consistent) pairwise model. The other difference is that additional features are given a lower weight in the pairwise analysis than in the scaled analysis, yet the ranking as least important among the criteria does not change.

We were also curious about the impact that internal and external experts might have on the results. W5 break out the scaled ranking based on internal vs. external we find the results are consistent; however, the internal results do show a greater emphasis on cost and implementation time (time to market). This is even more

pronounced when considering the evaluation of the CEO alone—even greater emphasis cost and time to market with even less weight to additional features. These results seem consistent with the viewpoint of an operating executive responsible for meeting revenue targets and external experts who may be more concerned with the overall goodness of fit of the solution.

2.8 Alternatives Evaluation

2.8.1 Data Gathering and Evaluation

After receiving the responses, all the vendors/proposals were put through a first level screen based on the core requirements. Those vendors that could not meet the minimum core requirements were not evaluated further—this eliminated five vendors from further consideration—leaving with seven to explore further for the final analysis (as detailed earlier).

2.8.2 Criteria Measurement Index (CMI)

Before analyzing the data of the remaining seven vendors, it was vital to first develop a tool for measuring the values with respect to the corresponding criteria.

2.8.2.1 Cost

Cost consists of several elements in this case. There is the cost of the initial system. In the case where we build the solution this might include software development costs. In the case where we build on a solution that already exists there may be a software license or hosting fee. Regardless on which solution is chosen, there will be recurring telecom fees based on usage; although the rates will vary by provider.

It was essential to create a cost metric that could capture all of these elements. We decided to select a minimum configuration based on the customer's requirements (5 toll-free numbers + 200 min; overage at $0.05/min) and then configured this solution for each vendor. In some cases a vendor's minimum configuration is greater than that—in those cases we used the minimum configuration.

We then assumed a 12 month usage period, totaled up all the costs associated with that period (including development and deployment) and then amortized it back out over 12 months to produce an amortized monthly cost for the first year. Given how frequently technology changes in this space we did not feel comfortable using a time period greater than 12 months. If this had been a longer time period, say 3–5 years, especially if borrowing funds, we would also incorporate the time value of money.

2.8.2.2 Implementation Time

When considering implementation time the old saying "time is money" hits home. In general, a shorter implementation time means a faster time to market. The faster we can get to market the faster we can generate revenue, grow market share, and establish a lead with respect to competitors. Thus, there is a inverse relationship between time and ranking—the smaller the value the better. If the client had given us an absolute deadline (e.g. it can't take any longer than 4 months) then we would have included that in the initial screening criteria to eliminate infeasible solutions in advance [3].

2.8.2.3 Integration

The experts expressed that a range from 0 to 5 can be assigned to the vendors by measuring the ability to connect to external systems or applications; with a value of 0 being a "closed system" with no ability to connect, and 5 being an "open" or "custom designed" solution with complete flexibility to connect.

2.8.2.4 Reliability

We considered a measure such as meantime between failure (MTBF) but decided against it because this is mostly a hardware rather than service measure. In addition, most vendors, as service providers, do not track this measure. It was also not feasible to consider just downtime (or uptime) because most systems require periodic maintenance. If this is scheduled maintenance it is routine to manage. Thus, we decided to focus on unscheduled downtime—the smaller the amount of unscheduled downtime that occurs the better for the client and the service provider [4]. This implies an inverse relationship.

2.8.2.5 Additional Feature

Additional features can be quantified by estimating the number of additional features beyond the core feature set required by the client. The ranking is a value from 0 to 5, with 0 being a system that exactly meets the requirements of the client, and 5 representing a solution that has almost unlimited additional features (e.g. custom development)—everything else will lie somewhere in between [5].

2.8.2.6 Competitive Advantage

The experts indicated that competitive advantage can be measured evaluating the solution provided and how easy it is to be duplicated by the competitors. A ratio from 0 to 5 can be assigned depending on how unique the solution is. For instance,

Table 2.4 Summary of cost elements

Provider	Cost (index)	Cost: setup (one-time)	Cost: operation (monthly)	Cost (monthly)	Minutes	Numbers	Average
XO Communications	0.32	$13,000.00	$24,000.00	$3,083.00	40,000	As needed	0.050
Call Fire	0.98	$12,000.00	$240.00	$1,020.00	As used	5	0.050
Dynamicic	10.20	$588.00	$588.00	$98.00	750	5	0.069
Who's Calling	1.85	$500.00	$6,000.00	$541.67	2,000	20	0.150
Dial 800	18.10	$75.00	$588.00	$55.25	200	5	0.050
Call Source	3.78	$600.00	$2,572.00	$264.35	50	12	0.069
Customer Direct	1.48	$2,000.00	$6,108.00	$675.67	As used	1	0.050

Who's Calling is assigned a value of 0 since it can be purchased "off the shelf" by any provider; on the other hand a completely custom solution would rank very highly on this scale because no other vendor would have access without the same level of investment.

2.8.3 Proposals Data Analysis

Proposals were collected and all data was gathered from the responses to match the identified criteria of the second level of the model.

The first step in this analysis was to compile and adjust all the cost data. Table 2.4 summarizes all the offers cost information from the proposals.

2.8.3.1 The Cost of Setup

There was a one-time setup cost associated with all the proposals except for Call Fire. In the case of Call Fire and XO Communications considerable custom development will also be required. These costs, are estimated to be ~$12,000 in either case. This estimate is based on 3 months of development time using offshore resources—If developed domestically we would increase these costs by a factor of 3.

Also for Customer Direct, the initial system personalization costs $1,500 (normal $250 waived). Plus the service only comes with a single DID. It costs $100 to setup each DID, so there is another $500 to get us to the same level as the other packages.

The Cost of Operation

The monthly fees were provided in the proposals. Using that information the total annual costs were calculated as the monthly fees times 12 months. Therefore, for the companies that provide less than 200 min, the remaining minutes were also included with the overage charges. For instance, Call Fire charges for the minutes

as needed, so their operation cost was calculated as (5*2*12)+(200*0.05*12). This represents $2/toll free number per month for 12 months, plus 200 min/month at the overage rate of $0.05/min for 12 months. Another example of this can be found with Customer Direct, the operation cost was calculated as $499/month for unlimited calls, plus $0.05/min for call tracking and recording for 200 min to be consistent with client requirements.

Total Monthly Cost

As previously outlined, setup and operating costs were rolled up into a single number and then amortized over 12 months to create a single monthly cost estimate. This is the number that was ultimately used in our evaluation.

For the other criteria the raw data are presented in Table 2.5 below.

2.8.3.2 Implementation Time

The offers included the installation times, except for XO Communications and Call Fire as they would require custom application development, which was estimated by the client to be approximately 3 months (12 weeks) worth of work. Of course, software development schedules are often notoriously unreliable. We did not add any additional cushion for software over-runs.

2.8.3.3 Integration

The experts assigned values for the integration (from 0 to 5). As described earlier, custom developed (open) solutions earn a 5, while totally closed solutions earn a 0, others are somewhere between.

2.8.3.4 Reliability

The experts were also to evaluate the reliability values, and they had to contact the service providers to provide some technical assessment, which in return allowed them to estimate total annual unplanned downtime. As we would expect, telecom carriers such as XO should score well on this metric.

2.8.3.5 Additional Features

The additional features that come with the package were quantified and the "package" was assigned a value (from 0 to 5). In the For example, XO owns the switch and thus there are additional capabilities that would allow the customer to squeeze out a richer solution built on this platform.

Table 2.5 Summary of additional criteria elements

Provider	Implementation time (weeks)	Implementation time (index)	Integration (0–5)	Reliability (h/year)	Reliability (index)	Additional features (0–5)	Competitive advantage (0–5)
XO Communications	12	0.83	5	2	5.00	5	5
Call Fire	12	0.83	5	4	2.50	3	4
Dynamicic	2	5.00	1	8	1.25	0	1
Who's Calling	3	3.33	2	4	2.50	2	0
Dial 800	1	10.00	1	8	1.25	0	1
Call Source	2	5.00	2	4	2.50	2	1
Customer Direct	2	5.00	2	12	0.83	1	2

Table 2.6 Summary of normalized and adjusted criteria

Provider	Implementation time (index)	Integration (0–5)	Reliability (index)	Additional features (0–5)	Competitive advantage (0–5)	Cost (index)
XO Communications	0.83	5	5.00	5	5	0.32
Call Fire	0.83	5	2.50	3	4	0.98
Dynamicic	5.00	1	1.25	0	1	10.20
Who's Calling	3.33	2	2.50	2	0	1.85
Dial 800	10.00	1	1.25	0	1	18.10
Call Source	5.00	2	2.50	2	1	3.78
Customer Direct	5.00	2	0.83	1	2	1.48

2.8.3.6 Competitive Advantage

This represents the ease of duplication by competitors. As indicated by the experts a value from 0 to 5 can be assigned.

For example, XO Communication was assigned with a value of 5 since it is completely a custom solution based on XO API. Any competitor who wants this solution would need to buy it from the client (unlikely) or commit to the same level of investment (time, capital, and risk). On the other hand, Who's Calling was assigned a zero value since they have an off the shelf offering available to anyone.

2.8.4 Data Compilation

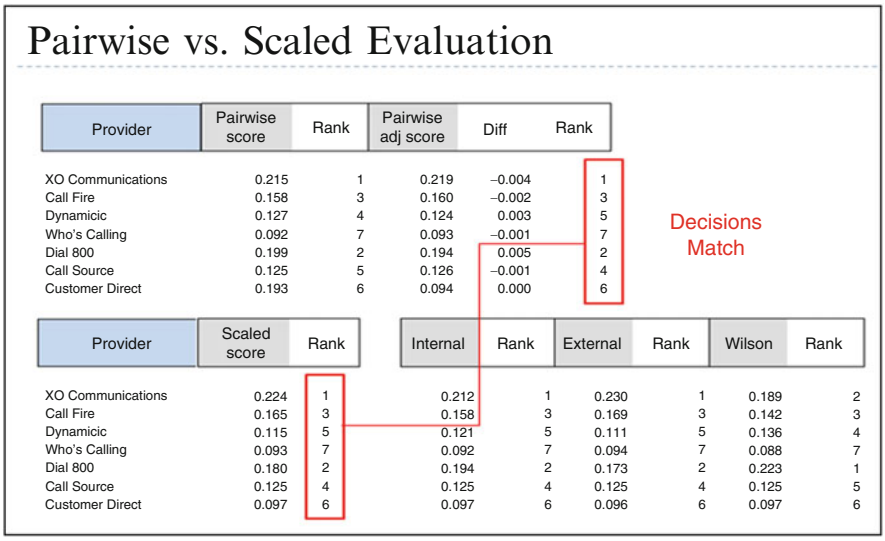
After pulling all the data together, the values need to be adjusted so that they all have the same priority orientation—in this case, a larger number being more favorable then a small number. The reciprocals of implementation time (IT), reliability (R), and cost (C) were calculated to make this adjustment. These adjusted values can all be found in Table 2.6.

Once these numbers were compiled then we applied the prioritization from the expert ranking to evaluate the relative attractiveness of the solutions. The results of this analysis, using both pairwise and scaled analysis results, are summarized in Table 2.7.

When exploring these results, we find that regardless of the approach that is taken, pairwise or scaled, the outcome is very similar. The top ranked solution is XO Communications, followed by Dial 800, Call Fire, Call Source, Dynamicic, Customer Direct, and Who's Calling, respectively. It is interesting to note that Who's Calling pioneered this class of solution and was the industry leader for many years. They now rank last at least when considered in the context of our requirements.

Although the outcome is consistent between approaches, and pairwise comparison is a much more rigorous technique, the panel of experts all agreed that the scaled evaluation was far more intuitive and allowed them to see how all the elements related before submission —a characteristic that they really appreciated as a group.

Table 2.7 Comparison of pairwise and scaled rankings



In the case of XO Communications they got top marks for integration, reliability, additional features, and competitive advantage. These scores were able to overcome the lowest ranks in the group for cost and implementation time. The high weights given to reliability really worked in their favor in this analysis.

The other interesting thing to note is that if we re-visit the scaled analysis and break-out the results for internal vs. external weights the ranking remains the same; suggesting a consistent view of the optimal solution from both sides of the fence. On the other hand, when comparing the results using the weights from the CEO alone we find that Dial 800 rises to the top of the list. This is consistent with the high weights he gave to implementation time and cost—the two criteria where Dial 800 leads the pack.

2.9 Other Considerations

One other thought to consider is that the evaluation of these solutions is based on a specific set of client requirements (e.g. 5 toll-free numbers, 200 min, and a specific set of features). If this basket of "required" features were to change then the outcome might change as well. Say, for example, the use of this solution grew to the point that it required 2,000 min a month, then that would tend to favor those solutions that a higher base level of minutes.

Since these solutions are independent, and we considered solutions with no more than a 12 month commitment, it may be possible that there is a chain of optimal solutions. In other words, this is the optimal solution for months 1–12; another

Table 2.8 Software project outcomes 1994–2009

	Standish Group findings by year updated for 2009						
	1994	1996	1998	2000	2002	2004	2009
Succeeded (%)	16	27	26	28	34	19	32
Failed (%)	31	40	28	23	15	18	24
Challenged (%)	53	33	46	49	51	53	44

Source: http://www.galorath.com/wp/software-project-failure-costs-billions-better-estimation-planning- can-help.php

solution might rule for months 13–24; and another might be superior beyond that. Of course, the rapidly changing landscape of technology makes this a little hard to predict, but we may want to explore a "chain" of optimal solutions in future research.

The final factor to take into account is that we did not make an adjustment for implementation risk in the solutions that required custom development. As noted earlier, software development schedules have a nasty habit of stretching out and consuming more time than anyone forecast—and that only considers the case where the project is actually delivered (Table 2.8).

In fact, the Standish Group, in its 2009 Chaos report concludes that only 32 % of software projects are successful (on time, on budget, and include all the required features/functionality); 44 % were challenged (delinquent along one of these vectors); and 24 % failed all together (canceled or never used) [6]. In further research work we would suggest adding an additional factor to compensate for the higher risk associated with custom develop—we know there is almost no implementation risk associated with turning on a private label version of Who's Calling.

Finally, given the extremely large number of solutions in the market, this analysis could be expanded to cover an even large group of vendors and offers. With that said, we did evaluate a representative sample of the different types of solutions available, these solutions meet the customer requirements, and the customer could still feel comfortable moving forward with this analysis; although the larger the investment, the longer the time commitment, the more essential it becomes that we include as many feasible solutions as we can.

2.10 Conclusion

Based on the current set of requirements, and the solutions available at the time of this analysis, XO Communications provides the best overall solution available. In this particular case, we reach this same conclusion whether we use the pairwise comparison method or the scaled ranking method; although our experts appeared to prefer the intuitiveness of the scaled ranking; and the project team appreciates the rigor associated with pairwise comparison. Additional research is still required, but it may be that in some cases where the number of criteria gets very large, an area where pairwise gets more challenging, that the scaled ranking provides a viable alternative.

In this case reliability has the highest weighting which really played to the strength of the solution from XO Communications (along with others). This really helped offset the cost disadvantage of this solution. In the case where a company (client) is more cost sensitive, and is willing to trade reliability, competitive advantage, integration, and additional features for cost and time to market, a solution such as Dial 800 that leads on these fronts might be another alternative to consider.

Regardless of which solution the company chooses today, they should continue to scan the market to be aware of changes to their requirements that might affect this choice, or emerging new technologies that would provide an even more effective solution.

Appendix

No.	Company name	Website address
1	XO Communications	www.xo.com
2	Call Fire	www.callfire.com
3	Dynamicic	www.dynamicic.com
4	Who's Calling	www.whoscalling.com
5	Dial 800	www.dial800.com
6	Call Source	www.callsource.com
7	Customer Direct	www.customerdirect.com
8	Integra Telecom	www.integratelecom
9	Answer Connect	www.answerconnect.com
10	Call Experts	www.callexpert.com
11	We Answer	www.weanswer.com
12	ansafone.com	www.ansafone.com
13	3COM	www.3com.com
14	Aastra Telecom	www.aastra.com
15	ADTRAN Inc.	www.aastra.com
16	Dialexia Communications Inc.	www.dialexia.com
17	Cisco Systems Inc.	www.cisco.com
18	Ring Central	www.ringcentral.com
19	E Voice	www.evoice.com/
20	My 1 Voice	www.my1voice.com
21	Free Voice	www.freevoicepbx.com
22	Fonality	www.fonality.com
23	freelineusa	www.freelineusa.com
24	Intelecom Solutions Inc.	www.intele-com.com
25	Talk Switch	www.talkswitch.com
26	All Worx Corp	www.allworx.com
27	MiTel	www.mitel.com
28	Vertical Communications	www.vertical.com
29	AVAYA Inc.	www.avaya.com
30	SOHOware	www.sohoware.com
31	Shoretel	www.shoretel.com
32	NEC Corp. of America	www.necwave.com

References

1. Kalpana Ettenson (2010) Enterprise Phone Systems Buyer's Guide. Technology Evaluation Centers [Online]. http://whitepapers.technologyevaluation.com/html/20732/enterprise-phone-systems-buyers-guide.html
2. Kocaoglu DF (2011) Hierarchical decision modeling. PSU ETM EMGT 530 Class Notes Spring
3. CrumDD (2011) Introduction to VoIP Business Communications, http://www.positivearticles.com/Article/Criteria-for-Selecting-Your-VOIP-Solution/41687. Accessed 21 May 2011
4. AVAD Hosted VoIP PBX Business (Ed.) (2010) https://sites.google.com/a/avadtechnologies.com/business-voip/business-voip-articles/small-business-voip-articles/critieria-for-selecting-a-voip-service-provider. Accessed 14 Jan 2010
5. PROGNOSIS (2007) Multi-vendor IP telephony management: challenges & solution
6. The Standish Group (2009) CHAOS summary 2009. http://www.standishgroup.com/newsroom/chaos_2009.php
7. Dan Galorath (2008) (updated Sep. 2009) Software project failures cost billions. Better estimating can help. http://www.galorath.com/wp/software-project-failure-costs-billions-better-estimation-planning-can-help.php
8. Daim T et al (2009) Technology assessment for clean energy technologies: the case of the Pacific Northwest. Technol Soc 31:232–243
9. Mantra Solutions. http://www.mantra-solutions.com/about%20us.html
10. Ajgaonkar A, Jefferis S (2003) Use of HDM for site selection of MLB stadium in Portland, PICMET Paper
11. Kocaoglu DF (1983) A participative approach to program evaluation. IEEE Trans Eng Manage EM-30(3)
12. Ajgaonkar, Priya. et. al. " Use of Hierarchical Decision Modeling for Site Selection of a Major League Baseball Stadium in Portland". PICMET 2003.

http://www.springer.com/978-3-319-05650-0

Technology Development
Multidimensional Review for Engineering and Technology Managers
Daim, T.U.; Neshati, R.; Watt, R.; Eastham, J. (Eds.)
2014, XII, 300 p. 99 illus., 63 illus. in color., Hardcover
ISBN: 978-3-319-05650-0