ADVANTAGE
FOR ANALYSTS

A CASE FOR A NEW FINANCIAL MODELING METAPHOR

Better Financial Analysis by Design

Executive Summary

Over time, electronic spreadsheets have not only been a source of competitive advantage for businesses, but have also fundamentally changed the relationship between computer programmers and financial analysts. Organizations that rely on sophisticated financial modeling have gained tremendous flexibility in developing financial applications, as today's analysts perform many tasks that would have traditionally been performed by IT professionals. However, this flexibility has come at the cost of exposure to an increasingly urgent set of issues.

High-profile spreadsheet errors and spreadsheet fraud, as well as studies that report undetected errors in over 90% of surveyed spreadsheets, have elevated spreadsheet risks as a key issue for many organizations. These risks arise not only from common practices used to develop and manage models, but are also attributable to a combination of the inherent structure of spreadsheets and the advanced functionality available in current spreadsheet applications. As a result, today's spreadsheets lack transparency and are notoriously difficult to audit.

These issues continue to build at a time when financial analysts are finding themselves in an environment of unprecedented performance pressure. A number of concurrent market factors such as globalization, a proliferation of financial instruments, an increase in deal scope and complexity, continually changing regulatory mandates, and the current surplus in capital, have contributed to an evolution in financial analysis. As they need to process a greater number of increasingly complex analyses in less and less time and collaborate with a greater number of involved parties, analysts are constantly forced to make trade-offs between the quality and timeliness of their analyses.

This trade-off implies not only a greater risk for errors, but ultimately a lack of organizational scalability. In their efforts to accelerate the modeling process, analysts are limited by the size and complexity common to today's spreadsheet models and are finding themselves in a situation where their needs have surpassed the functionality available in current spreadsheet technology. A state of the art modeling tool could enable analysts to shift the focus of their modeling efforts from data manipulation towards analysis and decision-making by accelerating the modeling process and improving insights to be gained by multiple parties. Specifically, features such as rapid prototyping of models, high level modeling and analysis, and increased transparency in model formulas and model structure would improve both modeling speed and the quality of analyses performed.

A crucial reason for the gap between modelers' requirements and available spreadsheet functionality is the fact that advances in spreadsheet technology is inherently limited by the underlying grid-based metaphor. This artifact has prevented the incorporation of several key technological advances that have revolutionized software development over the last two decades, such as high-level model hierarchies, classifications, and abstraction. To effectively address today's financial analysis requirements, an entirely new modeling metaphor is needed.

A new modeling platform that fulfills financial analysts' most pressing requirements would utilize layers of modeling abstraction, merge top-down model creation with bottom-up modeling of the detailed numerical models, formalize artifacts such as deal participants, financial instruments, and timescales that already exist in modelers' minds, and provide an ability to describe transactions through diagrams that are connected to the underlying model. These features would combine to provide a more intuitive modeling approach that has the potential to greatly speed up model development and analysis, improve communication, and reduce the risk of errors.

Organizations that equip their analysts with such a state of the art modeling tool will retain a long-term competitive advantage through rapid insights and confident decision making. The modeling platform described in this paper would push model structuring and navigation beyond the limits of traditional spreadsheets, taming complexity and simplifying communication with all involved parties, and ultimately enabling organizations to regain control over their financial models.

The evolution of financial modeling in the context of technological and economic trends

Over time, advances in spreadsheet technology have gone hand-in-hand with increasingly complex developments in financial modeling needs. As users of spreadsheet applications have become more sophisticated, so too have spreadsheets. Today, sophisticated spreadsheet modeling is a core skill required for most corporations to remain competitive.

Financial modeling as a source of competitive advantage

The first electronic spreadsheets in the 1960s enabled accountants to perform relatively simple tasks such as automatic summation and algebraic transformations, and to compile information that previously needed to be gathered from many paper sources. Despite the early programs' simplicity, this access provided financial analysts at the time with a centralized and high-level perspective on an organization's finances, which quickly translated into a competitive advantage for early adopting organizations.

In the 1970s and early 1980s, improved spreadsheet functionality enabled analysts to easily model the impact of financial transactions, thus greatly improving decision making support for deal makers. At the same time, charting capabilities elevated the role of spreadsheets to present data and communicate across an organization [Power, 2004]. Access to spreadsheets on a PC also represented an organizational shift towards decentralized planning, transferring planning activities to the analysts that were most knowledgeable about their business units, and once again providing a source of competitive advantage.

In the mid 1980s, the usability advances available with Excel on the Macintosh computer propelled spreadsheets to become an integral part of the information and decision-making framework for most companies. Decision makers started to rely on spreadsheets for modeling budgets and analyzing the performance of investments, easily considering multiple alternative financial scenarios, and greatly improving the efficiency and efficacy of their decision making processes.

Towards the late 1980s and 1990s, highly competitive capital markets resulted in conditions of intense time pressure for modelers, making speed and efficiency to model complex transactions—such as mergers and acquisitions—a critical factor for deal makers. Mirroring the increased creativity in financing arrangements, spreadsheets also became more complex, often consisting of multiple linked worksheets and supported with macros. The degree of sophistication of spreadsheet models during the last decade has been an important factor in advancing the state of the art in structuring financial deals.

Since the electronic spreadsheet's inception four decades ago, spreadsheets have thus enabled businesses to accelerate their decision making processes, produce greater insights into the consequences associated with their decisions, and improve their flexibility in responding to external events. As sophisticated spreadsheet models have become a core asset for many organizations, advanced modeling skills have become a key requirement for today's business analysts.

The analyst as programmer

In a parallel development, the last four decades also witnessed a fundamental change in the relationship between computer programmers and business analysts.

In the 1970s, spreadsheets introduced an irreversible trend towards independent computer usage by end users, originally defining the "personal productivity" segment together with word processing programs. Compared with the mainframe applications that existed until then, spreadsheets on PCs represented a user-friendly, interactive technology that enabled business analysts to design and develop many types of financial analysis tools that previously required the skills of professional programmers.

This trend accelerated in the late 1980s, when the introduction of object oriented programming fundamentally shaped the relationship between programmers and business analysts. Until then, procedural

programmers needed layers of communication to translate business requirements into supporting applications. Object oriented programming introduced heuristics that improved communication between professional programmers and business analysts, not only by enabling programmers to abstract large complex systems into modules representing the underlying business processes, but also by requiring business analysts to rationalize the business processes to be automated.

Object oriented programming ultimately enabled another far-reaching improvement in spreadsheet technology, the addition of VBA in the 1990s. In another shift away from programmers towards business analysts, Visual Basic enabled business analysts to develop entire end-user applications for financial modeling and routine financial transactions without involvement by IT departments. By circumventing the more formal IT development processes, analysts gained a tremendous amount of flexibility but introduced a new set of issues that concern many organizations today.

Reaching the limit?

In parallel with the increased complexity of modern financial models, the last two decades also saw the emergence of key risks associated with spreadsheet modeling. Stories abound of high-profile spreadsheet errors and spreadsheet fraud that caused large financial losses. Multiple studies conducted during the last decade have found undetected errors in an average of 94% of the spreadsheets analyzed [Panko, 2000]. These risks arise not only from the practices for developing and managing spreadsheets but also from the inherent structural limitations of spreadsheet technology.

While professionally developed software programs are subject to systematic testing, most spreadsheets developed by analysts do not undergo any formal quality assurance procedures. Developers and users of spreadsheets are usually not trained in structured programming, testing, version control, or systems development life cycles. In addition, spreadsheets are rarely restricted from unauthorized access by security controls [PWC, 2004].

Standard modeling practices such as reusing and modifying spreadsheets from deal to deal and between analysts, combined with a pervasive lack of documentation, further exacerbates the problem of error propagation. While weaknesses in the management and supervision of financial modeling practices could be overcome through more rigorous development processes, they also represent organizational realities that are difficult to change.

In addition, the key structural property underlying spreadsheets, i.e., the grid organization which originated by creating a mechanical abstraction of accounting spreadsheets, imposes limitations on some of the tasks supported by today's spreadsheets. The grid metaphor implies that each cell is identified only through its location and does not contain any functional information about its role in the model. Since formulas use cell locations as references (even cell names are just placeholders for locations), it is impossible to create a higher level understanding of a model's structure and dependencies. Through the addition of features such as macros, the ability to link multiple spreadsheets, goal seek, and pivot tables, users are able to overcome the grid metaphor's inherent limitations and build complex models. This incremental increase in functionality comes at the expense of both the time needed to construct models and confidence in a model's results.

The combination of spreadsheets' cell-based grid structure and today's advanced functionality contributes to notorious auditing difficulties, thus elevating the risk of undetected errors. The appearance of organizations like EuSpRIG (The European Spreadsheet Risks Interest Group) is a testament to organizations' increasing awareness of spreadsheet risks. A rapidly growing literature on best practices in spreadsheet design as well as numerous third-party spreadsheet auditing and inspection tools attempt to mitigate these risks. However, these tools and procedures are prone to undo some of the advantages of spreadsheet analytics, as they potentially restrict flexibility and decentralized innovation.

In today's financial markets, speed and flexibility are more important modeling attributes than ever before, and

organizations will strive to preserve these attributes in order to remain competitive.

Current developments in financial analysis

A number of concurrent factors have contributed to an evolution in financial deal analysis that has changed the environment in which financial analysts operate.

Figure 1 presents an overview of the factors that affect most of today's analyses:

Figure 1: Factors influencing today's environment for financial deal making

Globalization has created a new set of challenges and opportunities for the financial sector. As leading multinational firms and emerging enterprises access new markets across borders in ever more cost-efficient ways, evaluating and financing those opportunities requires a deep understanding of global capital markets, exchange rates, tax rules, and regulatory requirements.

In parallel, a *proliferation of financial instruments* has resulted in more sophisticated financing arrangements. Analyses include a growing number of financial instruments, such as synthetics and derivatives, as evidenced by the rapid growth of the credit derivatives market. At the same time, previously rare financial instruments are becoming commoditized (e.g swaps, CDOs).

The *increasing scope and complexity* of analyses can be partially attributed to the above factors. More diverse groups of parties tend to get involved in an opportunity, and alliances often include partnerships between corporations, fund management firms, and banks, each bringing complementary financial skills, industry knowledge, and operating experience to the table.

In addition, organizations operate under increasingly complex and frequently changing *legal and regulatory mandates*, as investors worldwide are demanding that companies provide more transparent financial information, and as more opportunities involve multiple regulatory jurisdictions. This development not only introduces compliance-related management and reporting processes to many organizations, but can greatly complicate the modeling of regulatory consequences of certain transactions.

A current *surplus of capital* to be deployed has had fundamental effects on the dynamics of financial markets by increasing the number of investors interested in each offering, increasing overall deal sizes, and making it more difficult to capture each opportunity. Some environments can be described as *hyper-competitive*, as evidenced by the prevalence of auctions in many private equity deals and the emergence of new categories of competitors. For example, corporations in search of acquisition targets are experiencing more competition from a broader set of financial buyers in addition to the customary strategic buyers [McKinsey, 2004]. These factors also contribute to an *increased market velocity* that requires organizations to react to more analyses in a shorter amount of time.

This convergence of market forces has altered the environment in which financial analysts operate and has created a new set of challenges for modelers.

The world of today's financial analysts

The typical modeling activities of a financial analyst during a deal cycle are depicted in Figure 2.

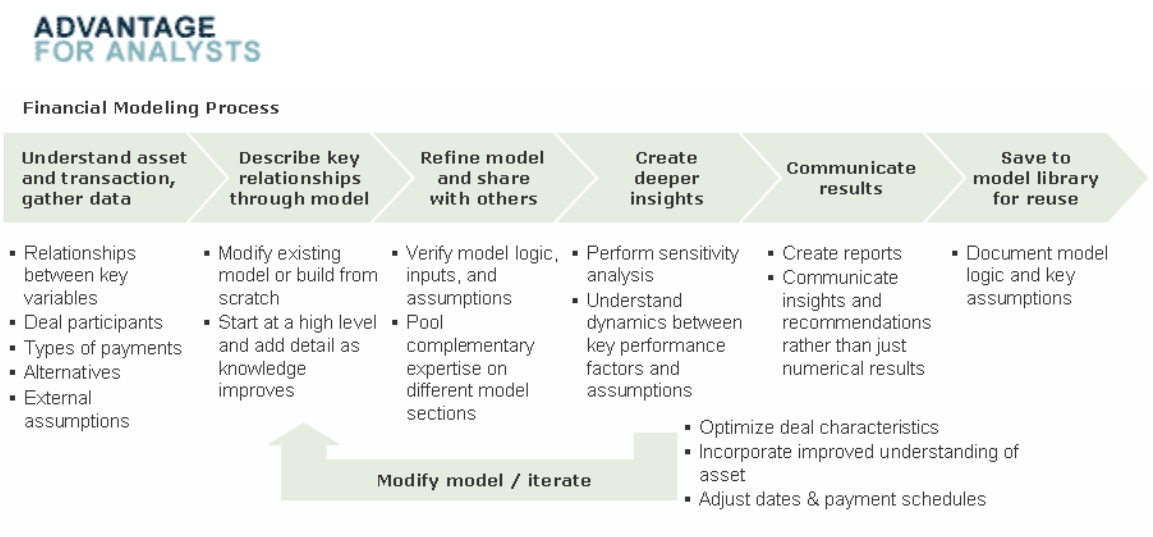

Figure 2: Typical modeling activities of a financial analyst during a deal cycle

Few companies attempt to formalize their financial analysis processes. However, formal documentation of analysts' tasks can highlight areas of heightened pressures and potential weaknesses. For example, the iterative and collaborative aspects of an analyst's activities are often underestimated, leading to excess time pressure and ultimately an elevated risk of errors.

Today's financial market environment has resulted in conditions that affect almost all aspects of an analyst's work described in the above process diagram.

- As large multinational deals are becoming commonplace, modeling complexities have increased greatly. Analysts need to model not only cashflow effects for more parties but also intricate tax and regulatory effects for a greater number of jurisdictions. In addition, pressure on investors to be increasingly creative in the financial structures that they bring to the table, coupled with a proliferation of financial instruments, implies not only that the number of alternatives to be analyzed has increased, but that their technical complexity has grown as well.

- Increased collaboration with multiple parties participating in opportunities has resulted in a common practice of intra- and inter-firm sharing of models, with the goal that all involved parties reach a collective understanding of underlying assumptions and their implications on results. However, as more parties get involved, opportunities also tend to experience an increased number of revisions, putting further strain on process management and creating risks for errors due to version control.

- A strengthening of regulatory requirements in many markets has resulted in an increasing need to include the regulatory consequences of some transactions in financial models. Recent developments in regulatory mandates (e.g. Basel II, Sarbanes-Oxley) have also resulted in a higher risk of noncompliance, subjecting spreadsheets to increasing scrutiny through formal audit processes. In addition, the rate at which regulations are changing has increased, imposing a need for greater analytic flexibility on analysts.

- The current environment of surplus capital, heightened competitive pressure, and increased market velocity implies that analysts need to investigate more market opportunities. This requires not only an ability to process and capture more opportunities more rapidly, but also to quickly and confidently eliminate bad deals.

- Finally, widespread organizational downsizing, coupled with a scarcity of highly skilled analysts, have created additional pressure on resources.

Figure 3 summarizes the effects of recent financial market developments on today's financial analysts:

Figure 3: Effects of financial market developments on today's financial analysts

In this environment, analysts consistently find themselves in a state of acute time poverty, and in their efforts to accelerate the modeling process, are limited by the tools and resources available to them. Specifically, analysts are hampered by the size and complexity common to today's spreadsheet models, where even minor changes such as adjusting a model's timeline can require a series of complicated edits by tracking cell references throughout a large model.

The prevalent practice in most organizations is to develop models for new opportunities by adapting existing spreadsheets, often originally developed by others. Since the cell-based grid structure of spreadsheets limits the ability to create a high-level view of a model, analysts often spend an excessive amount of time understanding an existing model's structure and are prone to introducing unwitting errors when making seemingly straightforward changes. The cell-based structure also hampers effective exploration of models, limiting the insights to be gained by analysts other than the creators of a model.

Ultimately, this implies not only a trade-off between the quality and timeliness of an analysis, but also a lack of organizational scalability. It is safe to say that the needs of financial analysts have surpassed the functionality available in current spreadsheet technology. To support analysts in today's accelerated environment, technology needs to preserve the benefits obtained through modern spreadsheets while curbing some of the associated risks.

Requirements for a New Financial Modeling Technology

Requirements for a financial modeling technology that addresses the above challenges span all aspects of an analyst's activities, but center around accelerating the analytical process and improving insights to be gained by multiple parties:

- Since most opportunities start with high-level discussions about an asset and its financing structure, a tool that enables *rapid prototyping* of models would not only improve communication during the structuring phase but

support early exploration of different financing alternatives.

- The ability to *easily adapt detailed models* is a key requirement for accelerating the development process and minimizing errors.
- Using *name-based* rather than location-based references and *hierarchically organizing* models would greatly facilitate transparency and the process of understanding and auditing models.
- The ability to maintain a *transparent model structure* throughout an opportunity's development cycle, even once the detailed analytics are in place, would greatly facilitate collaboration by multiple parties. At the same time, the ability to *make high-level changes* that propagate through the model, such as adjusting dates and payment schedules, would avoid common errors.
- As different financing options are being explored, the ability to effortlessly *swap alternatives* in and out of the analysis would speed up the modeling process, enabling analysts to focus on the creative aspects of deal structuring, and improve the overall analysis. At the same time, the ability to address the *perspectives of multiple participants* or financers through separate but connected cash-flow analyses would help illuminate the exposures and bottom line for each participant.
- The ability to flexibly *aggregate information* according to *what* is desired (as opposed to *where* it is located) would expedite analysis by allowing the analyst to focus on finance rather than data manipulation.
- An efficient method for performing *sensitivity analysis* would speed up the process of exploring the model's sensitivity to key assumptions, once again enabling more in-depth analyses.
- The ability to *independently save and reuse* frequently used model components would retain organizational knowledge, increase efficiency, and streamline the propagation of new knowledge.
- A *versioning tool* would facilitate the management of models that are adapted and reused over time.

A tool that satisfies the above requirements would support rigorous financial modeling processes and improve both modeling speed and the quality of analyses performed. *Most importantly, it would enable analysts to shift the focus of their modeling efforts from data manipulation towards analysis and decision-making*.

A New Modeling Metaphor

While financial modeling needs have always been a key driver of advances in available spreadsheet functionality, they have been developing faster than the supporting technology. This has resulted in a widening gap between modelers' requirements and available functionality.

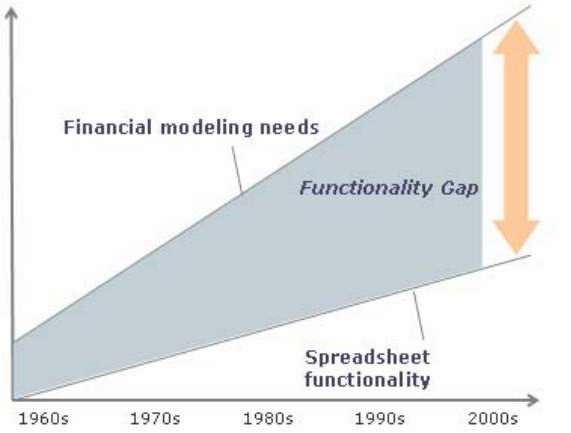

Figure 4: Widening gap between financial modeling requirements and availability of features

Spreadsheets fail to adequately address the modeling requirements outlined above, indicating a strong pent-up demand for a new solution. Advances in spreadsheet technology are inherently limited by the grid-based spreadsheet metaphor. This metaphor has prevented the development of some key technological advances such as high-level model hierarchies, classifications, and abstraction. To effectively address today's financial modeling requirements, an entirely new modeling metaphor is needed.

Over time, processes have traditionally been propelled to the next level by the emergence of certain enabling technologies. As outlined earlier, the most fundamental evolution in software technology over the last two decades was enabled by the invention of object oriented programming. The ability to abstract a large complex system, organize programming through high-level taxonomies, and easily communicate about the underlying processes to be supported, has propelled application development to new levels. It is time to apply similar technological advances to financial modeling and enable a new source of competitive advantage.

Some parallel technological developments indicate that the financial world is ready to accept a new way of thinking. For example, the ongoing worldwide acceptance of XBRL as a new standard in financial reporting indicates readiness for a next-generation modeling platform that would complement XBRL through a high-level object-oriented modeling approach.

A new modeling platform that fulfills the above requirements and utilizes state of the art technological concepts would consist of flexible building blocks providing the following key functionality:

- Modeling of high-level elements can be separated from low-level numerical details.
- Model elements are classified by their role in the deal, such as financial instruments and participants, enabling high level descriptions of relationships and cashflows.
- Formulas are easy to understand and use name-based references.
- Graphical diagrams directly connect each model element to underlying sub-models, and relationships between elements can be changed graphically. Figure 5 depicts an example of different model elements and their relationships in a flow-chart like format:

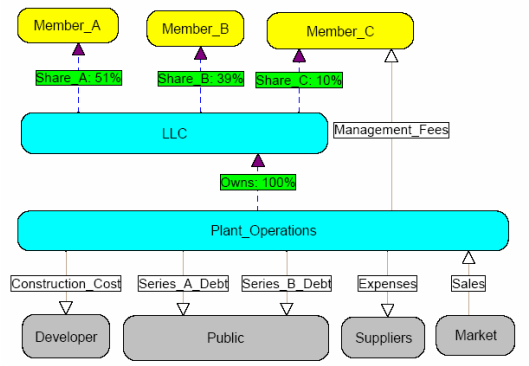

Figure 5: Graphical depiction of key model elements and relationships*

- Independent modules representing different elements of a deal can be easily connected, enabling separate modeling of asset performance and alternative financing structures.
- Outcome alternatives (e.g., Early Payment of Debt) maintained concurrently in a model simplifies calculations of expected values. Figure 6 illustrates decision branches associated with different outcomes and cashflow streams. Defining outcomes at this high level increases modeling speed and minimizes the risk of errors.

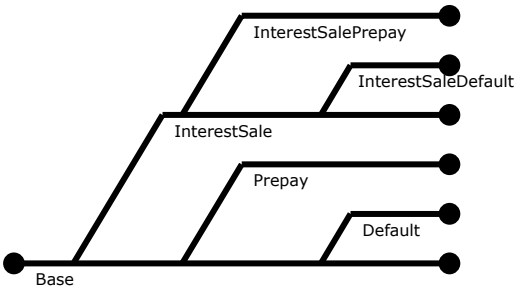

Figure 6: Decision branches for various outcomes.*

- Libraries of repeatable financial modules can be maintained independently and swapped in and out of models.
- Model results can be aggregated through specialized summary functions with various selection criteria, facilitating in-depth analysis.
- Models can be organized through document-style outlines.

* Source: Advantage for Analysts 5.0

- Starter models for common deal structures can be easily adapted.

This new modeling metaphor thus utilizes layers of modeling abstraction, marking a clear departure from the grid-based approach at the highest modeling level. The ability to merge top-down model creation with bottom-up modeling of the detailed numerical analyses represents a groundbreaking improvement over current spreadsheet technology. To analysts and principals accustomed to describing opportunities through diagrams, the ability to formalize artifacts such as objects and timescales that already exist in modelers' minds represents a more intuitive approach.

Examples

Organizations with access to such differentiating capabilities can experience measurable benefits, as the following examples elucidate:

Example 1: Regulatory changes

A regulatory change all but eliminated a category of leasing transactions valued at tens of billions of dollars annually. With the help of the modeling platform described above, an investment bank was able to easily capture the business rules associated with the regulatory change and disseminate those rules across the organization. The rapid insight and time-to-market obtained through its modeling capabilities enabled the investment bank to increase their market share from 20% to 50% as the category rebounded.

Example 2: Diverse investor objectives

Partnership structures for renewable energy are characterized by both the complexity of the assets' operating plans and the diversity of different investors' objectives. A global investment bank was able to become a leading manager of renewable energy assets through its capability to maintain model transparency with even the most complex deal structures and to communicate the impact of different financing options on each investor's positions.

Example 3: Emerging product areas

The complexity of modern financial instruments can cause sellers and asset managers to experience revenue leakage, unexpected losses, and mis-pricing. Investors that have the capability to compute the expected value associated with complex covenants (e.g., buy out options, asset conversions, rate adjustments, etc.) and to easily model the effect of probabilistic events (e.g., early buy out, termination, default, etc.) will be able to rapidly and accurately price deals that include the most complicated instruments.

Despite their diversity, these examples share a key characteristic: The featured businesses are able to leverage their advanced modeling capabilities to convert situations that traditionally would be perceived as obstacles into opportunities for increased market success.

Conclusions

To remain on top in an increasingly competitive global marketplace, organizations need to move away from the risky and limiting status quo and explore technological and other methods of enhancing the clarity, accuracy, and efficiency of their financial modeling practices.

Today's financial analysts spend a considerable amount of their time performing activities traditionally classified as software programming. Organizations

that equip their analysts with state of the art modeling tools based on modern software technology will develop differentiating capabilities and long-term competitive advantage through rapid insights and confident decision making.

The above-described modeling platform would push model structuring and navigation beyond the limits of traditional spreadsheets, taming complexity and simplifying communication with all involved parties, improving the trade-off between timeliness and quality of an analysis, and ultimately enabling organizations to regain control over their financial models.

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