BIG CHALLENGES IN DATA MODELING

by Graeme Simsion and Charles Roe
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EXECUTIVE SUMMARY

This report examines the biggest challenges faced by data modelers at both quantitative and qualitative levels. It discusses the results of four different data modeling surveys in 2007, 2009, 2011, and 2012 taken by some of the leading industry practitioners and thought leaders in online surveys. It then compares those results with three separate data modeling webinars from May, June, and July, 2012, conducted by DATAVERSITY™ (www.dataversity.net).

Challenges such as business support, availability of data modelers with proper skill levels, effective data modeling tools, and the successful use of Enterprise Data Models have been part of the conversation for years and are still seen as important issues by our survey respondents. But since 2007, there has been a growing interest in adapting data modeling techniques to deal with new technologies and opportunities, including Big Data and Unstructured Data, NoSQL and other non-relational platforms.

The combined results of the surveys and webinars uncovered several noteworthy findings:

• 59% said that obtaining organizational support and the presentation of models to non-technical users are the biggest challenges faced.

• 28% said issues with tools and other technical issues such as metadata integration, creation of various types of models are the primary challenges.

• Knowledge of the business (30.3%), verbal communication skills (25%), and knowledge of normalization (13%) ranked as the top three most important data modeler skills from all four surveys.

• In 2012, only 15% had a completed Enterprise Data Model, while 60.9% reported a partially-completed Enterprise Data Model.

• The principal use of the Enterprise Data Model is for supporting applications integration at 68.2%.

• ERwin is the most used data modeling tool (61.4%), Visio Enterprise is second (36.1%) and ER/Studio ranked third (25%), averaged over all four surveys.

• The most important tool functionalities are forward and reverse engineering (24.4%), an intuitive user interface (23.6%), and a repository that allows objects to be created once and used many times (17.1%).

• Only 8% of the respondents to the 2012 survey listed Agile, Big Data, or emergent technologies as the biggest challenge facing them as modelers.

• Only 29% of the respondents from 2011 and 2012 surveys believe that Agile practices are a major influence on the current jobs.

• The numbers are even lower with Big Data and NoSQL, with 23% saying Big Data is a significant influence on the current data modeling profession, and only 11% citing NoSQL as a significant influence.
REPORT METHODOLOGY

In 2007, 2009, 2011, and 2012 Wilshire Conferences (officially part of DATaversity as of 2012) conducted data modeling surveys and presented the primary findings at the annual Enterprise Data World Conferences. This conference is conducted as a joint venture between DATAversity and DAMA International (www.dama.org).

Each of the surveys, developed with input from Steve Hoberman and Graeme Simsion, covered what were perceived to be the most pertinent data modeling issues at the time. The surveys were answered online and allowed for free-form comments by respondents in a number of sections.

- 2007 Survey (7S): A total of 537 respondents took the survey.
- 2009 Survey (9S): A total of 452 respondents took the survey.
- 2011 Survey (11S): A total of 102 respondents took the survey.
- 2012 Survey (12S): A total of 259 respondents took the survey.
- Total Survey Numbers: A total of 1350 respondents took the survey over four years. The number certainly includes some respondent crossovers over the course of the surveys, but that issue was not addressed during collation of the results. If a respondent took the survey every year, their responses are counted as four not one.

DATAversity also conducted a series of three webinars in May, June, and July, 2012, titled “Big Challenges in Data Modeling.” Graeme Simsion moderated each session with a panel of industry experts. Those webinars and the public chat records have been used in this report to highlight and add emphasis to the survey results:

- May 2012 webinar (May12W) on future challenges in data modeling, with panelists David Hay, Karen Lopez, and Alec Sharp.
- June 2012 webinar (Jun12W) on Big Data with panelists Peter Aiken, April Reeve, and Ben Coverston.
REPORT DEMOGRAPHICS

The survey questions differed somewhat from year to year to reflect new trends in the profession and issues raised by responses to earlier surveys. The 12S was the only survey that asked a closed-ended question about the industry, with 255 respondents answering. The top five represented industries accounted for 69% of the respondents and were Consulting (16.5%), Insurance (16.1%), Government (12.6%), Finance (12.4%), and Healthcare (11.4%) [Figure 1]:

**WHAT INDUSTRY ARE YOU IN?**

The 7S, 9S, and 11S had the same choices for the question on job roles, while the 12S changed job role to job function with a slightly different set of choices. The respondents were allowed to check “all that apply” for the question and so could select many different possibilities. The results of the first three years were as follows [Figures 2, 3, 4]:

- **7S:** 527 respondents gave 2360 responses (4.48 responses per person) with Data Modeler (75%), Architect (65.1%), and Business Analyst (50.3%) as the main answers.
- **9S:** 443 respondents gave 1587 responses (3.58 per person) with Data Modeler (73.4%), Architect (69.5%), and Business Analyst (39.1%) as the main answers.
- **11S:** 100 respondents gave 260 responses (2.6 per person) with Data Architect (67%), Data Modeler (49%), and Business Analyst (28%) as the main answers.

The 11S changed the terminology of “Architect” to “Data Architect,” which then became the most popular choice. This possibly reflects a trend in job titles, but it may also be a result of people in earlier surveys whose title was “Data Architect” choosing “Data Modeler” rather than “Architect” as the nearer match.
Figure 2. 2007 Survey, 527 respondents.

Figure 3. 2009 Survey, 443 respondents.

Figure 4. 2011 Survey, 100 respondents.
The 12S asked about job function rather than job role, and once again respondents could choose more than one answer. 253 respondents gave 451 answers (1.78 per person); of those, the primary job functions were [Figure 5]:

- Data and/or Information Architecture 70.8%
- Information/Data Governance 28.1%
- Business Intelligence and/or Analytics 24.9%
- Application Development 10.3%
- Executive Management 8.7%
- Software Engineer/Developer 8.7%

![WHAT IS YOUR JOB FUNCTION](image-url)

Figure 5. 2012 Survey, 254 respondents.
The profile of the respondents has remained fairly constant over the course of all the surveys. There were no significant changes in the percentages of job roles chosen by the respondents, with data architect/architect, data modeler, and business analyst the primary roles in the first three surveys, and data and/or information architecture as the overwhelming job function choice in the 2012 survey.

The 12S was the only survey that asked the number of employees in respondent’s organization (254 responses), with the largest percentages being Over 50,000 (19.8%), 1,000-5,000 (19.4%), 10,000-50,000 (18.6%) [Figure 6, 7]:

As Figure 6 shows, a little more than half of the respondents came from organizations employing more than 5,000 people.

The numbers of data modelers within organizations have remained fairly stable over the course of the 9S, 11S, and 12S (the 7S used an open-ended question and the results were too unsystematic to properly collate). Out of 716 respondents, the top three answers were:

• 2-3 data modelers: 24.8%
• 4-6 data modelers: 19.8%
• 1 data modeler: 16.2%

The growth of the numbers of specialist data modelers within an organization is expected to either stay the same (46.1%), increase (46.3%), with very few indicating a decrease (7.6%).

Outsourcing is not seen as a direct challenge to data modeling and was not mentioned in any of the open-ended survey questions or during any of the webinars as a major challenge to the discipline, but it does still exist and so has been added as an illustration of some of the trends within the entire Data Management industry. The 7S and 9S used the term “offshoring” while the 11S and 12S changed it to “outsourcing.” The term includes the use of consultants and work conducted by other personnel who are not employees, not just overseas work. Each of the surveys had four choices (none, some, most, all) in regards to the amount of outsourcing going on within the organization for various functions including:

• Project Management, Analysis, Modeling, Database Administration, Development, Testing, Support, Entire projects from beginning to end (only on 7S and 9S), Data Integration (only on 11S and 12S)
The major trends within the industry show a general increase in outsourcing industry-wide. From 2007 to 2012 all of the job functions showed marked increases in the “some” choice:

- Project Management: increased from 22.6% to 56.3%
- Analysis: increased from 30.9% to 62.2%
- Modeling: increased from 20.9% to 40.3%
- Database Administration: increased from 24% to 35.5%
- Development: increased from 46.7% to 56.7%
- Testing: increased from 40.8% to 48.9%
- Support: increased from 34.2% to 42.9%

**Differences in Surveys**

The essential elements were included in each of the surveys, although each survey included some differences due to changes in the industry, responses from prior surveys on the quality or effectiveness of the questions, and need for more diverse range of data. All of the surveys asked some form of the questions on job role/job function, outsourcing, and numbers of specialist data modelers. They also all included one or more questions that asked the respondents to rank the importance of various data modeling skills (such as knowledge of normalization or knowledge of the business), the modeling tools used within the organization, and the satisfaction levels with the tools:

- The 7S had 34 closed-ended and six open-ended questions. It is the only survey that asked questions on the use of dimensional or relational ar-
chitecture for data warehouses, building star schemas and problems encountered with them, opinions about normalization techniques, use and structure of data model review processes, use of Conceptual models within the organization, metadata requirements in terms of attention given to various types, percentages of databases built from already existing structures, and rankings on the biggest debates within organization (such as when to use surrogate keys and star schema versus snowflake). The 7S also included a series of questions pertaining to the creation, implementation, and use of an Enterprise Data Model.

- The 9S had 14 closed-ended and four open-ended questions. It kept the standard questions on offshoring job roles as well as the question on Enterprise Data Models, but removed most of the questions on architectures, star schemas, normalization, data model review process, Conceptual models and others from the 7S. It was the first survey to include a question on Agile practices.

- The 11S diverged further from the preceding two surveys. It had 11 closed-ended and three open-ended questions. It kept the standard offshoring (now called outsourcing), numbers of specialist data modelers, skill importance, and tools questions. It was the first survey to ask about the impacts of new trends and technologies such as Cloud Computing, NoSQL, Big Data and others. The 11S did not ask about Enterprise Data Models.

- The 12S had 17 closed-ended and four open-ended questions. It added a closed-ended question that asked in what industry the practitioner worked, whereas the previous surveys asked an open-ended question, causing too broad a spectrum of results to collate accurately. It kept the standard questions present in all the surveys such as numbers of specialist data modelers, outsourcing, tools, and tool functionality. It added more questions on Agile practices, reinserted in-depth questions on Enterprise Data Models, kept the 11S trends and technologies question, and added in an open-ended question on “What is the most challenging issue you face in Data Modeling.”
OVERVIEW OF THE DATA MODELING LANDSCAPE

Data modeling has undergone many changes since the early years of network and hierarchical data models. The end of the 1960s saw the creation of relational modeling paradigms, along with early work in conceptual modeling techniques. The 1970s saw the development of entity-relationship modeling, while the 1980s had significant changes with object-role modeling (ORM). The 1990s presented a challenge to traditional approaches to modeling, notably the focus on normalized structures, with the advent of the data warehouse and dimensional modeling. Also, the Unified Modeling Language (UML) became the first widely-accepted alternative to modeling conventions. By the late 1990s, the rise of the Internet and XML also challenged traditional practices. The growth of Agile software development practices at the turn of the millennium forced data modelers to examine the role of data modeling within the development process.

Resistance to change is evident in any profession, and data modeling is no exception. As each new technology entered the scene, the traditionalists fought against it, the gurus and newcomers praised and adopted it, and the discipline eventually accepted the changes into the fold. Yet even with such transformations, much data modeling is still undertaken in ways that owe more to the early work of Charles Bachman and Edgar F. Codd than later developments.

A DISCONNECT OR RESISTANCE TO CHANGE?

The results of the 11S and 12S demonstrate a potential disconnect within the data modeling world, insofar as the trends identified as significant by the survey designers and highlighted by the first panels in the “Big Challenges” forum are not identified by survey respondents as having a major impact on their roles. The 11S and 12S surveys included a question about the impact of these new trends:

• “How will your role be impacted by the following technologies & trends, both today and in 2015 (2020 in 12S)?”

Each survey asked about Agile practices, cloud computing (including SaaS), unstructured data, Semantic Web technologies, Big Data, and NoSQL databases. The respondents were given three choices: “major influence,” “minor influence,” and “not relevant to me.”

The survey results demonstrate that data modelers throughout the profession do not believe that any of these trends are having a major influence on their current work and even the predictions of influence four and eight years out (2015 and 2020) were less than might have been expected from the level of attention that these topics have been receiving. When the results for 2011 and 2012 are added together, a total of 299 practitioners answered the questions, (though some questions had a +/- deviation of up to 5 respondents). The detail of these results will be discussed in later sections of this report, but some examination is necessary here to elucidate the possible disconnect:

• Agile practices garnered only a 29.3% major influence, 45.7% minor influence, and 24.9% not relevant to me. This number increases to 55.2% for the 2015 prediction, but then lowers again to 34% for the 2020 prediction. So while Agile development practices are certainly on the rise throughout the world, data modelers do not see them as a major influence.

• Big Data has even less of an influence on the current data modeling profession; only 23.3% of 295 respondents said that it is a major influence today (2011 and 2012), while 54.5% said minor influence, and 22% said not relevant to me. The numbers change to 65.1% major influence in 2015 and then to 51.7% major influence in 2020. The data management industry is inundated with white papers, research reports, and industry pioneers saying Big Data is here and now; is it really true that by 2015 or 2020, Big Data will be a major influence on somewhere between 50-65% of modeling practitioners?
The numbers are skewed even more when NoSQL databases are considered. In 2011/2012, with 293 respondents, NoSQL databases received 10.9% major influence, 39.5% minor influence, and 49.4% not relevant. Such numbers are not too surprising since NoSQL databases only became a major point of discussion in the industry during the past 3-4 years. Only 19.8% of the 2011 respondents believed NoSQL will be a major influence by 2015, 50.6% minor influence, and 34.6% said NoSQL will not be relevant to them as data modelers. Even in the longer view taken by the 2012 survey, the figures are 34.6% major influence, 38% minor influence, and 27.3% not relevant.

None of the Technologies & Trends were considered important enough in 2011/2012 to be considered a major influence on the profession. Agile practices came in at the top at 29.3% when both years are averaged. Cloud computing only gets a 17.4% major influence and Semantic Web Technologies received 15.2% [Figures 9 &10]:

**Figure 9** 2012 Survey, 209 Respondents

**Figure 10** 2012 Survey, 209 respondents.
The 12S also asked:

- “What is the most challenging issue you face in Data Modeling?”

The open-ended answer received 98 relevant responses. The answers were broken down into various categories:

- Roles/Skills: Typical data modeler roles such as selling the model to business users, providing for user requirements, time constraints, issues with executives, enough skilled resources, client acceptance and similar topics, but not including the skills needed to cope with the new technologies.

- Tools: Issues of various tools, types of models (conceptual, logical, physical), integration with metadata, simulation, semantics, normalization and others, again not including tools to cope with new technologies.

- Agile: Specifically mentioned issues with Agile practices

- Enterprise Data Model: Problems at the EDM level

- Emergent Technologies: Big Data, Unstructured Data, NoSQL and others mentioned above in Figures 7 & 8.

The numbers really highlight the issue. The data modeling profession does not see the supposedly looming changes in data management ideas and technologies as pertinent to their sphere; instead, their focus is on the issues that have been around for many years. Of the 98 respondents 57% gave Roles/Skills answers, 28% Tools, 7% Enterprise Data Model, 4% Agile, and only 4% answered Emerging Technologies. Agile has been around now for more than 10 years and is prevalent in many enterprises, but only 4% of the data modelers in the 12S say it is a big challenge, or the biggest challenge. Of the 57% who fell into the Roles/Skills category, the most common answer was getting the business to understand the value of the modeling or getting buy-in from business users, with a total of 33 out of 56 (59%) responses.

The primary conclusions from the May12W panelists and chat comments are not surprising based on the statistics presented above. They demonstrate that the essential challenges in the current and future data modeling landscape, according to practitioners, are not the same challenges voiced by other data management pundits for the rest of the industry. The May12W focused on both current challenges and emergent technologies, so a significant portion of the discussion centered on Big Data and NoSQL. The main challenges raised during the May12W by both panelists and chat participants were:

- Presentation of models to non-technical audiences

- Selling the value of data modeling to the business

- More focus on business needs, with less focus on implementation and the final product or “the perfect data model”

- More emphasis on conceptual modeling, which also may help data modelers to be more sought out in the emerging non-relational world

- Adaptation of relational approaches to accommodate Big Data and other emerging technologies

- Better engagement with NoSQL and other non-traditional databases

- More education/training of current practitioners in the newest trends and technologies

- Growth of new data architects, data modelers, and other data experts within colleges and universities (the old guard is get-
ting old, a new guard is needed, but data modeling is not as stimulating as the newest trends)

• Changing from a control-oriented mindset where the model is the only focus, to a service-oriented mindset that focuses on communication and marketing

The May12W panelists are all experts in the field, they are aware of the changes on the horizon, but when asked about challenges, most initially spoke about the traditional issues cited during the past 30 years. Once the topic moved to the newest trends and technologies in the industry they all agreed, as did the attendees within the chat stream, that Big Data, NoSQL, Semantics, and others will be key future challenges. However, the issues that current practitioners see as the most pressing concerns (those preeminent in their minds and in survey answers) are still the same challenges that they have dealt with their entire careers, not the topics filling up the Data Management blogosphere, white papers, and conference halls.

Agile practices were not raised at all during the one-hour May12W session, neither by the panelists nor by attendees during the chat. Given that Agile was not mentioned even once during the entire one hour May webinar, is Agile really not that important to data modelers?

The Jun12W session dealt specifically with Big Data and NoSQL and so the results of that session will be discussed in the relevant topic areas later in this report.
DATA MODELING ROLES AND SKILLS

Tasks performed by data modelers include creating standards, developing models, documenting them, reviewing them with other members of the team, assisting developers and DBAs in creation of the required databases, cooperating with business analysts and other employees to get user requirements, and working with various project teams to make sure the entire SDLC (software development life cycle) runs smoothly.

Each of the four surveys asked participants to rank the skills a data modeler should possess and each ranking could only be chosen once. The 7S and 9S used a nine-point ranking scale for each of the choices, with 1 (most important) and 9 (least important). The 11S and 12S used a ten-point ranking scale, with 1 (most important) and 10 (least important). All the surveys had a core group of the same eight skills:

- Knowledge of normalization
- Understanding of dimensional modeling concepts
- Verbal communication skills
- Documentation skills
- Knowledge of the DBMS
- Knowing when to stop
- Knowledge of data model patterns
- Knowledge of the business

The 7S/9S also included the skill “knowing the line between ideal and practical” that was not part of the 11S/12S. The 11S/12S included “knowing how to work with Agile teams” and “knowledge of non-traditional data stores such as NoSQL and XML,” which were not on the 7S/9S. Averaged from the four surveys, the top rated skills were [Figures 11, 12, 13, & 14]:

- Knowledge of the business, 30.3%
- Verbal communication skills, 25%
- Knowledge of normalization, 13%

In both the 7S and 9S, the least important skills were:

- Knowledge of the DBMS 28.9%
- Knowing when to stop 15%
- Understanding dimensional modeling concepts 12.2%

The potential disconnect between trends and respondents’ perceptions of the issues, discussed in Section 3, is evident in the 11S and 12S, as they were the only surveys to list Agile and NoSQL:

- Knowing how to work with Agile teams ranked as the second least important skill;
- Knowledge of non-traditional data stores such as NoSQL and XML ranked as the least important skill.
RANK THE FOLLOWING SKILLS FROM 1 (MOST IMPORTANT) TO 9 (LEAST IMPORTANT) THAT A DATA MODELER SHOULD POSSESS.

Figure 11. 2007 Survey, 469 Respondents

RANK THE FOLLOWING SKILLS FROM 1 (MOST IMPORTANT) TO 9 (LEAST IMPORTANT) THAT A DATA MODELER SHOULD POSSESS.

Please note: You must use each ranking only once. You cannot give two skills the same ranking.

Figure 12. 2009 Survey, 393 Respondents

RANK THE FOLLOWING SKILLS FROM 1 (MOST IMPORTANT) TO 10 (LEAST IMPORTANT) THAT A DATA MODELER SHOULD POSSESS.

Please note: You must use each ranking only once. You cannot give two skills the same ranking.

Figure 13. 2011 Survey, 68 Respondents
RANK THE FOLLOWING SKILLS FROM 1 (MOST IMPORTANT) TO 10 (LEAST IMPORTANT) THAT A DATA MODELER SHOULD POSSESS.

PLEASE NOTE: YOU MUST USE EACH RANKING ONLY ONCE. YOU CANNOT GIVE TWO SKILLS THE SAME RANKING.

The perceived critical skills for data modelers have not changed much over the course of six years (and we might speculate, given the top-ranking skills, that this trend might extend back 20 or 30 years), not even with the advent of Agile and NoSQL. Knowledge of the business, verbal communication, and knowledge of normalization still rank as the most important skills. Yet, is knowledge of normalization going to be as important going into the future with non-relational systems as it was in 2007 or even 2012? How will these skills change over the course of the next five to ten years with the continued growth of Agile practices, non-relational databases, and Big Data?
THE ENTERPRISE DATA MODEL

The 7S, 9S, and 12S all contained the same questions (the 11S did not ask a question about Enterprise Data Models):

- Does your organization have an Enterprise Data Model?
- What is the purpose of the model?
- How well is this goal achieved?

The 7S and 9S only allowed for “yes” and “no” responses to the first question, while the 12S added in “yes, partially completed” to the possible answers.

The 7S had 474 respondents and 51.5% (244) said their organization had an EDM. The 9S had 367 respondents and 54% (198) said yes to having an EDM. The 12S had 220 respondents and 15% (33) said yes, while 60.9% (134) said partially completed [Figure 15].

In organizations using an Enterprise Data Model, supporting applications integration and providing a starting point for application modeling are the primary purposes of the EDM.

All three surveys had the same answers for the question pertaining to the purpose of the model, and the answers were similar each year, with only some deviations in the third through sixth rankings. Respondents could check all that applied, so more than one choice was possible [Figures 16, 17, 18, 19]:

- The top reason: “Supporting applications integration,” with 74.4% in 7S, 68.1% in 9S, and 62% in 12S, so over the course of six years, it has lessened in terms of primary purpose when compared to other choices, but still exists as the overall main purpose for an EDM.

- The second leading reason: “Providing a starting point for application modeling,” with 69.7% in 7S, 64.2% in 9S, and 53.3% in 12S.
Overall, the results demonstrate that applications integration and providing a starting point for applications modeling are the primary purposes for the EDM in most enterprises. There have been some changes over the course of the surveys, though. In 2007, supporting a metadata repository held the third spot, but was the fourth spot in 2009, and had dropped to fifth in 2012. Business intelligence has risen in prominence over the six years as well, and as of 2012 was perceived as the third most important purpose for an EDM.

The degree to which organizations said they achieved their goals further clarifies the use of an EDM. Since only 51-60% of enterprises seem to be using an EDM — mostly for applications integration, metadata support, and initial help with application modeling — the goal would be for EDM to have exemplar achievement in those purposes. Yet, the results show a different reality. The respondents had three choices for goal achievement (not all at, somewhat, and very) [Figures 20, 21, 22]:

- The overall highest percentage for all choices was “somewhat” in terms of goal achievement, with an average of 55.3% across-the-board. The

*Acting as a starting point for application modeling and Business Intelligence are the most successfully achieved purposes of an EDM within the respondent organizations.*
highest specific “somewhat” rank went to supporting applications integration at 61.4%.

- Supporting a metadata repository received the worst ranking with 32.4% of respondents saying “not at all.” Information systems planning came in as second worst with 30.6%.

- The top two most successful purposes of using an EDM, with a “very well” goal achievement ranking, were “providing a starting point for application modeling” (23.4%) and “business intelligence” (21%).

The results show some sharp contrasts and clearly highlight the challenge of EDMs implementation. From 2007-2012, 51-60% of organizations reported using EDMs, and in 2012, only 15% of the EDMs were fully completed. The organizations are predominantly using EDMs for applications integration, supporting metadata repositories, acting as initial elements in application modeling, and more recently for business intelligence activities. However, the organizations that do use EDMs are only somewhat satisfied, with 12-21% saying it achieved their goals “very well” in 2012.
DATA MODELING TOOLS

Selecting and deploying data modeling tools has always been a challenge. There are a plethora of tools on the market and most organizations want to make a long-term commitment to a product and its associated methods. There are budget requirements for licensing, training time constraints, and productivity losses while modelers learn new techniques.

Each of the four surveys asked respondents to identify the modeling tools they use in their organizations, and rank the tool functionalities in terms of most important (1) to least important (15). There were some variations in the surveys, so the primary results are discussed and only the full results of 12S displayed:

- The 7S did not contain any tool functionalities and rankings

We identified and tracked seven modeling tools, with ERwin Data Modeler being the longstanding leader in terms of market adoption, in use at over 50% of the organizations surveyed. Deployment of Visio Enterprise and ER/Studio has also been consistent over the survey period. The largest increase in adoption in the past 3 years has been for PowerDesigner, which is now in use at almost 25% of organizations surveyed. [Figures 23, 24, 25, 26, 27]:

- ERwin Data Modeler: 7S (71.4%), 9S (62.8%), 11S (59.3%), 12S (52.1%)
- Visio Enterprise: 7S (41.6%), 9S (33.3%), 11S (34.9%), 12S (34.7%)
- ER/Studio: 7S (23.1%), 9S (21%), 11S (30.2%), 12S (25.8%)

The top three tools used all garnered competent satisfaction levels as well over the course of all four surveys, with ERwin at cumulative score of 49.6%/42.2% (somewhat/very satisfied) for 7S-11S (12S used a five choice scale, see Figure 34), Visio Enterprise at 57.3%/16.3% (somewhat/very satisfied), and ER/Studio at 42.2%/42.6% (somewhat/very). The highest (very) satisfaction levels for each year were PowerDesigner (50.6%) in 2007, ER/Studio (47.6%) in 2009, Sybase PowerDesigner (50%) in 2011, and Sybase PowerDesigner (32.7%) in 2012.
The survey asked respondents to rank 15 different tool functionalities on a 15-point scale from most important (1) to least important (15). The same tool functionalities were used for 9S, 11S, and 12S, so as a group they present an accurate picture of the most important tools data modelers need and use. The top three functions were the same in all three surveys, though their rankings fluctuated somewhat. The percentages reflect how many respondents ranked the feature as the most important feature [Figure 28]:

- Forward and reverse engineering (24.4%)
- Intuitive user interface (23.6%)
- Repository which allows objects to be created once & used many times (17.1%)

The most important tool functionalities are forward and reverse engineering, an intuitive user interface, and a repository for objects.
The top remaining modeling tool functions ranged across the board, but overall the top half (8 out of 15) of the rankings were:

- Linking feature to capture data element lineage and maintain model connections, such as between logical and physical, (9.7%)
- Automated checks to increase data model quality (9.3%)
- Metadata bridge to allow import/export of data model metadata, such as definitions (7.4%)
- Model comparison feature to allow identifying differences in two or more models (6.5 %)
- Export to widely available format such as XML, HTML, or PDF (5.2%)

The rest of the tool functionalities such as containing starter models, data profiling, linking of process model to data flow diagrams, macro language functionality, spellcheck, and support for different modeling notations all ranked in the bottom half of the three surveys.

![Figure 28. 2012 Survey, 206 respondents.](image-url)
AGILE/SCRUM PRACTICES

Originally described in the late 1980s, Agile and SCRUM projects gained popularity throughout the 1990s, and in 2001, the Agile Manifesto was published. While Agile and SCRUM are quite different in their implementations, for the purposes of this report, they will be discussed together since each work through iterative processes and they are similar enough to discuss together in opposition to traditional, incremental waterfall processes.

As demonstrated in Section 3, Figures 9 & 10, the majority of respondents from the 2011 and 2012 surveys said Agile practices either do not impact them today or are only of minor influence:

- 11S: 63 out of 89 (70.8%) respondents
- 12S: 144 out of 204 (70.6%) respondents

There is some discrepancy in the responses from the 11S and 12S regarding the influence of Agile practices in 2015 and 2020. However, the numbers match up close enough to suggest a large majority of data modelers/architects do not see Agile as an important impact on their lives, even looking toward the future:

- 11S: 55.2% major influence, 44.8% minor/not relevant in 2015
- 12S: 34% major influence, 66% minor/not relevant in 2020

Do these numbers reflect what is actually happening with the data management industry? Are Agile/SCRUM projects really not impacting the roles of modelers, or data modelers just resistant to the changes happening around them?

The Jul12W dealt specifically with Agile/SCRUM practices and focused on the use and relevance of data modeling for such projects. The panelists mostly agreed that the requirement of “fast” project completion is the largest challenge for data modeling in an Agile environment. The other primary concerns and solutions that arose during the panelist discussion and the chat stream were:

- Visibility: Data modelers need to provide more visibility of their work throughout the iterative processes. Posting “in flux” models in meeting rooms is one way to help the process.

- Speed: Data models must be delivered at the same speed as the other Agile project iterations, and should often stay one iteration ahead.

- Quality: Data modelers often want to produce the “perfect” model before moving on, as is common within the waterfall development process, but Agile does not allow time for this. Therefore, models must be “good” rather than “perfect” then more easily changed during later iterations.

- Perspectives: Data modelers need to alter their perspectives. Rather than always developing a complete model over many months or years, they need to create startup models that act as guides rather than set landscapes. Data modelers need to see themselves as partners that give guidance and value through their models within the Agile development process, not provide absolutes.

- Collaboration: Better communication within Agile teams, especially from the modeling side, is seen as a necessity. Agile is about collaboration, so modelers must work closely with DBAs, developers, and other teams to make sure everyone is clear about priorities and needs.

According to an overwhelming number of respondents, Agile/SCRUM practices are still not that influential to the data modeling profession.
Skills: Data modelers need to expand their skill sets and step outside their traditional comfort levels. Good data modelers can translate their skill sets into working with class models, object models, high level conceptual models, and learn to integrate patterns into their work to allow for faster development. They need to become more generalists, or better yet, specialists in multiple skills.

The 9S and 12S had specific Agile questions and the results, when combined with the Jul12W comments, are surprising in their implications. The 9S asked the question:

• “If you have even been the data modeler on an Agile project, how satisfied were you with the results?”

Out of the 310 respondents, 42.6% had never been on an Agile project. Two similar questions were asked on the 12S:

• “How much experience do you have on Agile and/or SCRUM projects?”
• “If you have ever been the data architect or modeler on an Agile project, how satisfied were you with the results?”

The leading response was “never,” with 33.8% (222 responses) from the first question and 36.2% (221 responses) from the second revealing they had not worked on an Agile/SCRUM project. Of all the responses that answered in terms of their satisfaction levels while working on an Agile/SCRUM project, only 12.3% were “very satisfied” in the 9S and 14.5% in the 12S [Figures 29, 30, 31].

**IF YOU HAVE EVER BEEN THE DATA MODELER ON AN AGILE PROJECT, HOW SATISFIED WERE YOU WITH THE RESULTS?**

![Graph 1](https://example.com/graph1)

**IF YOU HAVE EVER BEEN THE DATA ARCHITECT OR MODELER ON AN AGILE PROJECT, HOW SATISFIED WERE YOU WITH THE RESULTS?**

![Graph 2](https://example.com/graph2)

**HOW MUCH EXPERIENCE DO YOU HAVE ON AGILE AND/OR SCRUM PROJECTS?**

![Graph 3](https://example.com/graph3)
NOSQL AND THE NON-RELATIONAL WORLD

Traditional relational databases remain the principal form for storing data in the world today. Organizations still need their existing relational systems to hold established data types that require high levels of transaction integrity. But in the past few years there has been a fundamental paradigm shift occurring due to the growth of terabyte and petabyte-sized data stores, globally distributed storage systems, tens of thousands of CPUs, and the need for easily scalable, schema-free, and cost-effective platforms with faster deployment times.

The term “NoSQL” has a variety of definitions and could ultimately encompass all the emergent database technologies such as Key/Value stores, graph databases, MapReduce, object stores, column stores, as well as multi-dimensional OLAP cubes, XML databases and many others that various experts may or may not agree upon. The surveys did not ask respondents to give their own definitions, so for the purposes of collating the results of the surveys and webinars, NoSQL refers to the vast array of non-relational systems available on the market. Even more NoSQL refers to a group of evolving technologies that are altering the data management landscape in unprecedented ways.

The 11S and 12S asked some specific questions concerning NoSQL and its impact on data modeling today and into the future. The Jun12W session focused on NoSQL, along with Big Data (see Section 9), as the primary discussion topic. Evaluated together as a group, the data shows a rather remarkable trend in the data modeling community.

The statistics presented in Section 3 reveal that, for the most part, current practitioners do not see NoSQL as having much of an impact on their jobs: 47.1% said that NoSQL was not relevant to them in 2011, a number that went up to 55.3% in 2012. Only 14.4% and 2.4% of the respondents said that NoSQL had a major impact on them in each of the respective years, and over the next decade only 38% (11S by 2015) and 50.6% (12S by 2020) said NoSQL would even have a minor impact [Figure 32 & 33]:

NoSQL is growing in importance throughout the entire Data Management industry, but it is not yet having a major impact on data modeling.

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NoSQL is growing in importance throughout the entire Data Management industry, but it is not yet having a major impact on data modeling.
These numbers are brought into even greater focus when added to the 12S open-ended question:

- “In what ways do you anticipate data modelers and architects will need to update their knowledge skills to work with non-relational (NoSQL) databases?”

The 11S did not ask this question. From the 165 responses, 42 (25.4%) said some form of “same as before,” “not yet decided,” “no identified changes,” “none,” “very little,” “data modelers will have nothing to do with NoSQL,” or “I have no idea” as their response. The other responses were heavily centered on some form of education/training (68 responses or 41.2%), whether in terms of new tools or knowledge of the emergent platforms, as these direct quotes from survey show:

- “Knowledge of Hadoop, Data Visualization, NoSQL.”
- “They will need to develop a functional understanding of the value of non-relational data and how it supplements or complements relational data in supporting a business.”
- “Learn how to use NoSQL as data sources to populate more formally modeled structures.”
- “Knowledge of RDF, SPARQL, JSON-JD.”
- “More knowledge of distributed computing and figuring out how to transition from the traditional data architecture world to one not as dependent on RDBMS.”
- “Understand the scenarios where non-relational best applies. Understand how structure/Metadata is applied in non-relational contexts and bridge with the relational world.”
- “Understand the semantic stack: Linked Open Data Ontologies, OWL, RDF, RDF/S, Business Rules Triple Stores Javascript, JS Frameworks, schemas, geospatial concepts and modeling GIS and BI integration, etc.”
- “Object-relational, XML, Semantics.”

The other primary responses dealt more with a change of perspective and work roles for data modelers: 27 out of 165 (16.4%) said that modelers will be doing much more conceptual, information, and business process modeling, rather than the physical/logical modeling of today, since at this point, practitioners do not have the tools to adequately model at lower tiers in the non-relational world. They also said that data modelers will be doing more data analysis, handing increasingly more non-traditional projects, less design work, and need more flexibility in their mindsets. A few commented that NoSQL will force modelers to “unlearn” the fundamental concepts they already know because the non-relational structures are entirely different.

In the May12W and Jun12W sessions, the discussion shifted back and forth between NoSQL and Big Data since both are so intertwined. The essential agreement between the panelists, backed up by many of the chat stream comments, was that NoSQL is not a fad, but a major industry trend that will be increasing important going into the future. Data modelers need to become proficient with NoSQL platforms, become comfortable with the movement from ACID to BASE, accept the idea that there is no longer immediate data integrity, and modelers need to generate values at the same time as generating structures. There is a noticeable and significant lack of modeling tools at this time for non-relational systems as well. Most current practitioners trying to work with NoSQL are using their traditional tools and techniques, but such occurrences are being done only on an ad hoc basis, with varying degrees of success. It will be essential that some modelers become non-relational data architects, but that will take an extensive re-education program, as well as training a whole new generation of data modelers in completely new concepts.

Data modeling experts believe that NoSQL is major trend within the industry and needs to be addressed by current modeling practitioners. New tools to address non-relational structures are needed as is more education.
Organizations today are capturing, storing, sharing, and analyzing more data than ever seen in the history of data management. The challenges of Big Data touch on every part of the industry from data governance to data integration, data modeling to data quality, and everything in between. The ability to model the massive information structures at all levels from the physical to conceptual are forcing changes upon the industry that many specialists would prefer to avoid. Should data modelers really be concerned with Big Data? Are data modelers effectively dealing with Unstructured Data? Will Unstructured Data continue to grow at such astronomical rates? Will Big Data really have an impact on the data modeling industry in five years? Ten years? Or even in 2012? The prevailing opinion of the top experts in the field is “of course” and “yes.” Why, then, do such a high percentage of current modeling practitioners feel that such answers are not necessarily relevant?

There were no specific closed-ended questions about Big Data or Unstructured Data in any of the surveys, except for the figures discussed below. The primary results concerning the impact of Big Data on the data modeling profession were collected from the panel discussions and chat streams during the webinars.

Section 3 of this report already discussed the issue of Big Data to some extent. It presented the statistics from 11S and 12S that less than a quarter (23.3%) of the respondents from both surveys felt that Big Data was currently a major influence on data modeling. More than half (54.5%) said it was only a minor influence, with 22% saying it was not relevant. Projecting into the future, 47.7% said it will only be a minor influence or have no relevance in 2015, and a surprising 50.4% said the same of 2020. Unstructured Data had similar results, with only 19.3% saying it was a major influence in 2011, and 25.1% in 2012. In 2011, 13.6% rated Unstructured Data as “not relevant,” a number that rose to 25.6% in 2012. Do these figures mean a significant percentage of practitioners believe Big Data is just a fad that will disappear over the next 3-7 years? Is the modeling profession not really going to change that much as the world creates more and more zettabytes of data? [Figures 34, 35, 36, 37]:

Most respondents do not see Big Data or Unstructured Data as major influences on their profession at this time, but the number increases significantly moving into the future.
The May12W and Jun12W sessions focused partially on the challenge of Big Data, as did the 12S question:

• “What is the most challenging issue you face in data modeling?”

Only 4% of the 98 respondents to that question said emergent technologies — including cloud computing, semantics, and others — are their biggest issue at this time, and only two specifically said anything relating to Big Data:

• “Integration of structured and unstructured data”
• “Big Data, semi-structured, and unformatted data”

Data modelers have other concerns in their daily lives it seems, and Big Data is not one of them.

When asked at the beginning of the May12W session, “What is the major challenge in data modeling today?” the primary responses of the panelists and chat stream comments were similar to the same problems faced by practitioners for the past 25-30 years: production and presentation of models to non-technical audiences; the “best” approach to aesthetics; and a need for more conceptual modeling to aid in the creation of logical and physical models. These are not new and none of them will go away soon.

When the focus of the session moved towards the future though, the panelists and commenters began to discuss Big Data and NoSQL (see section 8). Most agreed that currently available modeling techniques are not adequate for dealing with Big Data’s structures; relational databases are built around ACID constraints, and those do not necessarily work in a world ever more controlled by BASE requirements. Big Data still needs modeling though. ER models may end up being an insufficient solution, but a solution has to exist. Just because a company is collecting petabytes of data, whether structured or unstructured, the data must still be modeled if it is going to be useful. Enterprises still need conceptual modeling and clear descriptions of the business will continue to be the same no matter the technologies involved at the data level.

Webinar participants noted the need to rethink traditional boundaries between data and process. Big Data requires putting the processing into the data, rather than being so concerned with retaining the data in a specific relational form. Big Data requires data management alter its perspectives: Big Data analytics are more about watching the data as it streams past, while using algorithms to capture what is most important with those massive scale streams. But traditional requirements are still future re-

The need for data modeling will not lessen in the new world of Big Data, but the roles of data modeling practitioners will change. Modelers must change their perceptions and adapt to the changes that are overtaking the entire industry.
quirements. The processes still must be modeled. The distribution of the hardware must be understood, especially with the horizontal, distributed computing that Big Data demands, and the value still presented to the enterprise. The transition from Big Data to Accessible Data must still be understood at all levels, so the connections from virtual tiers to physical tiers and all the way up the ladder must be modeled. The filtering and capturing processes need formal plans; documentation still needs to be completed.

According to one panelist during the May12W session, the traditional statement that “the only answer to all data problems is relational,” no longer holds as much truth as it once did. The other panelists agreed. While data modeling is required to effectively and efficiently interact with Big Data, the panelists concluded practitioners must alter their perspectives and expand their toolsets to accommodate Big Data. Data modelers are experts in data, and with Big Data the datasets are at a scale never seen before. Practitioners need to be flexible, adaptable, and understand that their age old truths, where the model was the purpose and the goal, are no longer compulsory. Big Data is demanding a new dynamic, where the model is a guide. Data modelers will be essential to the creative process because of their data expertise. Modelers can help formalize processes, reduce uncertainty and imprecision, reduce risk, understand which relationships to model, and aid in the creation of new techniques and the adaptations of old ones.
The three webinars provide a clearer picture for the future path of the data modeling profession, especially when joined with the collated results of all four surveys. In each of the three webinars, the moderator asked the panelists for concluding thoughts on the session topic and, when taken as a whole, their comments reveal a direction. Data modelers must stay abreast of the trends that are transforming the data management industry, including Big Data, a growing preference for Agile projects, non-relational implementations, Cloud Computing, the Semantic Web, and other emerging developments. Altering perspectives is key, with more focus on service rather than control and re-training and education of current professionals needs to take place in all emerging arenas so data modelers can get hands-on experience with the new technologies. There needs to be more emphasis within the profession on recruiting so the profession stays active and has enough practitioners for the available jobs. Finally, data modelers need to expand their skill sets and become specialists in more than one piece of their field. All the panelists agree the value and need for data modeling is not going away, but it is transforming and changing all the time, and such change makes the profession an exciting place to be.
APPENDIX

LINKS TO DATAVERSITY WEBINARS ON BIG CHALLENGES IN DATA MODELING:

MAY 2012:

JUNE 2012:

JULY 2012:

AUGUST 2012:

SEPTEMBER 2012:

WEBINAR PANELIST BIOS FOR MAY, JUNE, AND JULY 2012 REFERENCED IN PAPER:

GRAEME SIMSION (MODERATOR)
Graeme Simsion managed a successful business and systems consultancy for twenty years. During that time, he built a personal reputation as a thought leader in the data strategy field. He now draws on that experience to deliver industry and academic education in consulting skills, and to coach individuals and consulting teams. He has published widely, including two books on data modeling, and is also an award-winning fiction writer.

KAREN LOPEZ
Karen Lopez is Principal Consultant at InfoAdvisors, Inc., a Toronto-based consulting firm, and has spoken at several DAMA conferences and DAMA Chapters. She has 20+ years of experience in project and data management on large, multi-project programs. Karen specializes in the practical application of data management principles. Karen is also moderator of the InfoAdvisors Discussion Groups at www.infoadvisors.com.

DAVID HAY
In the Information Industry since it was called “data processing,” Dave Hay has been producing data models to support strategic and requirements planning for more than twenty years. As President of Essential Strategies, Inc., for 18 years, Dave has worked in a variety of industries, including, among others, banking, clinical pharmaceutical research, and all aspects of oil production and processing. Projects entailed various aspects of defining corporate information architecture, identifying requirements, and planning strategies for the implementation of new systems.

ALEC SHARP
Alec Sharp has managed his consulting and education business, Clariteq Systems Consulting Ltd., for close to 30 years. Serving clients from Ireland to India, and Washington to Wellington, Alec’s expertise includes facilitation, business analysis, business process improvement, and, of course, data management. In addition to his consulting practice, he conducts top-rated workshops and confer-
ence presentations on these topics globally. Alec is the author of “Workflow Modeling, second edition,” (Artech House, 2008), which is widely used as a consulting guide and university text, and is a best seller in the field.

DR. PETER AIKEN
Peter Aiken is an award-winning, internationally-recognized thought leader in organizational data management, architecture, and engineering. As a practicing data manager, consultant, author and researcher, he has been actively performing and studying these areas for more than 30 years. His sixth book is titled XML in Data Management. He has held leadership positions with the U.S. Department of Defense and consulted with more than 50 organizations in 20 different counties. Dr. Aiken’s achievements have resulted in recognition in Outstanding Intellectuals of the 21st Century and bibliographic entries in Who’s Who of Emerging Leaders in America, Who’s Who in Science and Engineering, and other accolades. His entertaining but clear and concise insights make him a sought after speaker, lecturer, and consultant. He is an associate professor in Virginia Commonwealth University’s Information Systems Department and the founding director of datablueprint.com.

APRIL REEVE
April Reeve has spent the last 25 years working as an enterprise data architect and program manager. Currently she is working for EMC Consulting as a business consultant in the Enterprise Information Management practice on Data Governance and Big Data. April is an expert in multiple data management disciplines including data conversion, data warehousing, business intelligence, master data management, data integration, and data governance.

BEN COVERSTON
Ben Coverston has over 15 years of development experience. He has written code running on some of the largest travel websites in the world. He became interested in Big Data through his experiences in troubleshooting data related problems in which the velocity and volume of the data exceeded the capabilities of a single machine. He currently helps to coordinate the training and support activities at DataStax.

TERRY BUNIO
Terry Bunio has worked for Protegra for 10 years because of the professionalism, people, and culture. Terry started as a software developer and found his technical calling in data architecture. Terry has helped to create enterprise operational data stores and data warehouses for the financial and insurance industries. Along the way Terry discovered that he enjoys helping to build teams, grow client trust and encourage individual career growth, completing project deliverables, and helping to guide solutions. It seems that some people like to call that project management. As a practical data modeler and project manager, Terry is known to challenge assumptions and strive to strike the balance between the theoretical and real world approaches for both data modeling and Agile. Terry considers himself a born again Agilist as Agile implemented according to Lean Principles has made him once again enjoy software development and believe in what can be accomplished.

JOHN GILES
John has more than 40 years experience in IT, including senior roles with some of Australia’s leading IT consultancies. His major focus for some three decades has been on data modeling, and since the late 1990s has also specialized in UML class modeling. As a practitioner, he has consulted to organizations across industries as diverse as manufacturing, welfare, retail, construction, engineering, telecommunications, environment management, primary industry, land registry, transport, finance, defense and police. In addition, he has supported the modeling profession through developing & running numerous courses, presenting at seminars, publishing articles/papers, and contributing to the publications of others, including Graeme Simsion & Graham Witt’s “Data Modeling Essentials”, plus Graeme’s PhD which was the basis for “Data Modeling Theory and Practice”. He has been graded as a Fellow of the Australian Computer Society. John has also recently published “The Nimble Elephant: Agile Delivery of Data Models using a Pattern-based Approach.” John’s publisher has graciously offered a discount in the spirit of this webinar! Just use discount code: NimbleEle25 to receive 25% off John’s book when you order through Technics Publications.
Data modeling is more than just database design, because data doesn’t just exist in databases. SAP Sybase PowerDesigner is different and unique in the level of support it provides for both data modeling tasks and larger-scaled architecture implementations. PowerDesigner is an enterprise-standard modeling tool that provides effective impact analysis between all types of models, integrates with other components of your enterprise and supports over 80 RDBMS. For more information, visit www.sap.com and search on PowerDesigner.

CA ERwin® Modeling provides a collaborative data modeling environment to manage enterprise data. With ERwin, both business and technical stakeholders can have a common view of information in context, through both a web-based portal and desktop-based design tools supported by an enterprise-class model repository. CA Technologies (NASDAQ: CA) is an IT management software and solutions company with a deep expertise across all environments — from mainframe and distributed, to virtual and cloud. For more than 30 years CA Technologies has helped customers transform the highly complex ‘silos’ that characterize vertically disparate IT functions.