FORRESTER®

The Total Economic Impact™ Of The Neo4j Graph Data Platform

Cost Savings And Business Benefits
Enabled By Neo4j

OCTOBER 2021

Table Of Contents

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Executive Summary

> The Neo4j Graph Data Platform enables organizations to harness the inherent relationships in their data to reveal new insights, add greater depth to data analysis, and increase prediction accuracy. Neo4j is particularly well suited to handle large volumes of data with intricate relationships that need to evolve over time. The Graph Data Platform, built on Neo4j's native graph database, provides a broad range of development, data science, and integration tools and services that enable organizations to quickly create graph-powered applications and data pipelines.

Neo4j commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying the Neo4j Graph Data Platform.[1] The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Neo4j on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed five decision-makers with experience using Neo4j. For the purposes of this study, Forrester aggregated the interviewees' experiences and combined the results into a single composite organization.

Prior to using Neo4j, interviewees attempted to develop applications that tested the limits of traditional data structures, resulting in several issues:

- **Difficulty incorporating new data sources.** Interviewees reported that new data sources could not be incorporated into existing data schemas.

- **Limited resources.** Existing solutions were resource-intensive, proving too expensive to operate and maintain.

- **Stymied innovation.** Interviewees abandoned innovation because complex analytical models had unacceptable latency levels.

After the investment in Neo4j, interviewed customers realized desired business benefits, accelerated time-to-value (TTV) in on-premises and cloud environments, and reduced hardware and

KEY STATISTICS

Return on investment (ROI)
417%

Net present value (NPV)
$4.18M

maintenance costs. Additionally, interviewees reported that they had flexibility to add new data and advanced capabilities for application development that were previously impossible.

Key results from the investment include reducing the time to develop new applications through efficiencies in software development by 60%; improved business results of the model of an average of 20%; and more than $1.8 million in savings on hardware and maintenance.

KEY FINDINGS

Quantified benefits. Risk-adjusted present value (PV) quantified benefits include:

- **Improved business results by 20%.** Faster development cycles not only allowed the application to get to market faster but also resulted in better-performing applications. The composite organization achieved a 20% improvement on applications that targeted revenues of $5 million, yielding a benefit of more than $2.2 million over three years.

- **Accelerated TTV by up to 60%.** Using Neo4j, the composite organization was able to reduce the average development time from 12 months to four. For the development team of six, with an average annual fully burdened cost to the organization of $140,000, that represents a savings of more than $1.1 million over three years.

- **Digital transformation cost savings.** Adopting Neo4j allowed the composite organization to retire hardware and reduce the workload to manage those systems, saving the organization more than $1.8 million over three years.

"The main problem was that we had no flexibility to create new features. We would think of a way to do something cool with the activity feed, but we weren't able to execute because the existing infrastructure we had was such a big, rigid system."

— Senior software engineer, software

Unquantified benefits. Benefits that are not quantified for this study include:

- **Better collaboration with business stakeholders.** Faster development cycles alongside better data visualization in the form of graphs led to better collaboration between developers and business stakeholders.

- **Greater agility.** Faster development cycles allow developers to bring innovation to market faster, helping business leaders to rapidly respond to market forces.

- **Schemaless database.** Organizations can continue to discover and add relevant data to the graph without the need to fit it to the original model.

- **Organizational knowledge.** Interviewees reported that they had used Neo4j's Graph Data Platform to build a model of their organization, including traditional assets, to gain understanding that enabled them to move quickly on new strategies and initiatives.

Costs. Risk-adjusted PV costs include:

- **Neo4j license and fees.** The composite organization incurred costs for the Neo4j license and fees of $330,000 per year, for a total present value of just over $800,000 in three years.

- **Neo4j maintenance.** The composite organization allocated 50% of an FTE's time for maintenance of Neo4j.

The decision-maker interviews and financial analysis found that a composite organization experiences benefits of $5.19 million over three years versus costs of $1.00 million, adding up to a net present value (NPV) of $4.18 million and an ROI of 417%.

> **"It's just like you're building an airplane and you said, 'Oh, I have a great steam engine. Let's try with that first because that's what we use everywhere.' But you need a different thing. So what's the comparison of steam engines versus jet engines for aircraft? There's no real comparison."**
>
> *Principal architect, financial services*

ROI
417%

BENEFITS PV
$5.19M

NPV
$4.18M

Benefits (Three-Year)

Category	Value
Improved business results	$2.2M
Increased Time to Value in the Software Development Lifecycle	$1.1M
Digital transformation savings achieved	$1.8M

TEI FRAMEWORK AND METHODOLOGY

From the information provided in the interviews, Forrester constructed a Total Economic Impact™ framework for those organizations considering an investment in Neo4j.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that Neo4j can have on an organization.

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by Neo4j and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.

Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the study to determine the appropriateness of an investment in Neo4j.

Neo4j reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.

Neo4j provided the customer names for the interviews but did not participate in the interviews.

DUE DILIGENCE
Interviewed Neo4j stakeholders and Forrester analysts to gather data relative to Neo4j.

DECISION-MAKER INTERVIEWS
Interviewed five decision-makers at organizations using Neo4j to obtain data with respect to costs, benefits, and risks.

COMPOSITE ORGANIZATION
Designed a composite organization based on characteristics of the interviewees' organizations.

FINANCIAL MODEL FRAMEWORK
Constructed a financial model representative of the interviews using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the decision-makers.

CASE STUDY
Employed four fundamental elements of TEI in modeling the investment impact: benefits, costs, flexibility, and risks. Given the increasing sophistication of ROI analyses related to IT investments, Forrester's TEI methodology provides a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

Interviewed Decision-Makers		
Interviewee	**Industry**	**Region**
Data architect	Banking	Canada
Senior software engineer	Software	United States
Chief architect Enterprise innovation architect	Not-for-profit	United States
Principal architect	Financial services	United States

KEY CHALLENGES

Prior to the adoption of Neo4j's graph platform, interviewee's organizations attempted to solve complex data interrelation problems with highly skilled research teams using expensive processors. Adding new data was difficult. The interviewees noted how their organizations struggled with common challenges, including:

- **Barriers to digital transformation.** Due to inflexible data structures and systems, adding new data to models was slow and siloed. This prevented development teams from creating new digital solutions for internal customers.

- **Relational database limitations.** Transformational solutions were not achievable with the currently available relational database technology. Complex queries running on previous solutions often took too long to execute to be feasible in production.

- **Inefficient IT utilization.** The senior software engineer, running a recommendation engine, said: "It was taking a lot of computing power to actually power this feed. We were using 48 [data servers] to power this experience, and that was a very expensive solution."

  Maintenance of those systems was also costly, the senior software engineer continued: "It was

the human hour savings, and it's crazy. We would kind of joke with this DevOps guy we had that [the previous solution] was pretty much dictating his life."

> **"If you have an application that needs to make, say, five jumps, with Neo4j you can do it in a second or two. In a relational database that can run for 20 minutes, and that completely ruled out the ability for such an application to be interactive."**
>
> *Principal architect, financial services*

COMPOSITE ORGANIZATION

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an ROI analysis that illustrates the areas financially affected. The composite organization is representative of the five decision-makers that Forrester interviewed and is used to present the aggregate financial analysis in

the next section. The composite organization has the following characteristics:

Description of composite. The organization develops both customer-facing and internal business applications using Neo4j. There are six full-time developers working on applications using Neo4j.

Deployment characteristics. The composite organization deploys Neo4j Enterprise Edition as a self-hosted solution with a cluster of three to five medium-sized production machines operating on a major cloud provider and spanning one to three data centers, with corresponding test and development environments.

> **"Neo4j has added libraries that we use a lot like their graph data science library, which is a package with a lot of algorithms that you can use, and they keep adding to the list."**
>
> *Data architect, banking*

Analysis Of Benefits

Quantified benefit data as applied to the composite

Total Benefits						
Ref.	Benefit	Year 1	Year 2	Year 3	Total	Present Value
Atr	Improved business results	$900,000	$900,000	$900,000	$2,700,000	$2,238,167
Btr	Increased time-to-value in the software development lifecycle	$453,600	$453,600	$453,600	$1,360,800	$1,128,036
Ctr	Digital transformation savings achieved	$731,500	$731,500	$731,500	$2,194,500	$1,819,132
	Total benefits (risk-adjusted)	$2,085,100	$2,085,100	$2,085,100	$6,255,300	$5,185,335

IMPROVED BUSINESS RESULTS

Evidence and data. Decision-makers reported that they were able to achieve better results through better, faster data queries, better collaboration with business stakeholders, and increased ability to source additional data. One of the interviewees reported a significant uptick in customer engagement through an improved recommendation engine. In banking and financial services, both interviewees related examples of improved fraud detection models. In that case, one interviewee described how the Neo4j model not only allowed them to source more data to support the effort but detect suspicious accounts so that fraud was predicted and prevented.

- "It was so easy for us to run the design workshops with the business stakeholders. We both immediately were on the same page and understood what we were talking about. The technology team was able to translate the business into a graph model as they spoke. It was very simple, easy to contemplate."

- "The first thing we did was try to replicate what they had done manually or with other tools and we were able to do that and more because it was faster, it had more reach. I would say it was two months from the day we decided to start the

project loading the data to having the first test where we identified the first fraud ring."

> **"With the collaboration between us and product, they're really able to get into it and actually contribute to what the algorithm does in the end. Doing that with the previous version was a lot harder."**
>
> *Senior software engineer, consumer technology*

Modeling and assumptions. For the composite organization, Forrester assumes:

- The organization develops applications using Neo4j to target $5 million in revenue per year.

- The organization saw an improvement in model performance of 20% over previous models.

Risks. Savings from improved model performance may vary due to:

- The ability to develop better algorithms.

- The amount of revenue that the organization can directly target with models.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV (discounted at 10%) of more than $2.2 million

Improved Business Results					
Ref.	Metric	Source	Year 1	Year 2	Year 3
A1	Total revenue targeted	Interviews	$5,000,000	$5,000,000	$5,000,000
A2	Improved model	Interviews	20%	20%	20%
At	Improved business results	A1*A2	$1,000,000	$1,000,000	$1,000,000
	Risk adjustment	↓10%			
Atr	Improved business results (risk-adjusted)		$900,000	$900,000	$900,000
	Three-year total: $2,700,000			Three-year present value: $2,238,167	

INCREASED TIME-TO-VALUE IN THE SOFTWARE DEVELOPMENT LIFECYCLE

Evidence and data. Interviewed decision-makers reported that they were able to achieve efficiencies across the software development lifecycle. From the initial meetings with business stakeholders and data incorporation through to deployment of a production application, less time and effort was expended.

- The chief architect at a not-for-profit organization said: "It's just the fact that the business rules that had to be incorporated into an algorithm are 10,000 pages of documentation. I would say the time-to-realization, from deciding that that Neo4j was the right fit, was six to nine months, with a very small team of three people."

- The senior software engineer said: "One of the other things I like about graphs in Neo4j: It's very easy to prototype a large amount of data on your personal computer. So I did that, sold it to the team, and started the project. I'd say all in, we [spent] — from development to production — probably about four months, which is very

impressive for our standards. The project directly before that took almost a year."

Modeling and assumptions. The composite organization:

- Has a team of six full-time developers working on Neo4j projects.

- Incurs a total cost of salary, benefits, and overhead of, on average, $140,000 per FTE.

- Achieves a reduction in effort of 60%, on average, compared with the previous solution.

Risks. Savings due to increased efficiency in software development may vary due to:

- The size of the development team.

- The average fully loaded costs of developers.

- The percentage of time saved by developers.

Results. To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year, risk-adjusted total PV (discounted at 10%) of more than $1.1 million.

	Increased Time-To-Value In The Software Development Lifecycle					
Ref.	Metric	Source	Year 1	Year 2	Year 3
B1	Average data engineer fully burdened annual salary	Payscale.com	$140,000	$140,000	$140,000
B2	Size of development team	Composite	6	$6	$6
B3	Model development time saved	Composite	60%	$1	$1
Bt	Increased time-to-value in the software development lifecycle	B1*B2*B3	$504,000	$504,000	$504,000
	Risk adjustment	↓10%			
Btr	Increased time-to-value in the software development lifecycle (risk-adjusted)		$453,600	$453,600	$453,600
	Three-year total: $1,360,800			Three-year present value: $1,128,036		

DIGITAL TRANSFORMATION SAVINGS ACHIEVED

Evidence and data. The Neo4j graph data platform allowed interviewees to retire large, costly systems.

- The chief architect, not for profit said, "If we tried to do a 'square peg in a round hole with a sledgehammer' and had been using proprietary in-memory structures or a relational database (or some other NoSQL database) in order to do this, we would probably be using significantly more horsepower, CPU, memory, storage, cache, you name it, to accomplish the same work."

- The senior software engineer said: "We had an algorithm running, and we were powering it with [a previous solution]. It was using a ton of resources, and it was also costing a ton of money. About a year ago, we started moving those recommendations to Neo4j. And we A/B tested them against the expensive research team generator recommendations. Our graph-based recommendations perform better, and we cut out about $300,000 a year. That was in addition to the 48 [data servers]."

Modeling and assumptions. The composite organization was able to:

- Retire legacy hardware with a cost of $700,000 per year.

- Redirect 50% of a FTE's time to more productive activities.

Risks. Savings from retired hardware services may vary due to:

- The size and cost of the legacy system.

- The complexity of the legacy system and its management.

Results. To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year, risk-adjusted total PV of $1.8 million.

Digital Transformation Savings Achieved					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
C1	Value of retired hardware	Interviews	$700,000	$700,000	$700,000
C2	FTE per year to maintain	Interviews	0.5	0.5	0.5
C3	Total fully burdened annual salary per FTE	Assumption	$140,000	$140,000	$140,000
Ct	Digital transformation savings achieved	C1+(C2*C3)	$770,000	$770,000	$770,000
	Risk adjustment	↓5%			
Ctr	Digital transformation savings achieved (risk-adjusted)		$731,500	$731,500	$731,500
Three-year total: $2,194,500			**Three-year present value: $1,819,132**		

UNQUANTIFIED BENEFITS

Additional benefits that customers experienced but were not able to quantify include:

- **Better collaboration with business stakeholders.** In addition to the measurable benefits of improved model performance and better collaboration between developers and business stakeholders, Neo4j keeps business stakeholders engaged throughout the development cycle. Additionally, one interviewee reported that developers had a better understanding of the problem presented. With that insight, developers were able to experiment with previously unidentified data to improve results.

- **Agility.** Faster time-to-market not only has tangible benefits measured in the quantified benefits listed above but also allows businesses to more quickly respond to market forces.

- **Schemaless database.** The schemaless database allows business stakeholders and developers to add additional data as the discovery process continues. The data architect at a banking organization said: "Because this is a schemaless database, we can import data from anywhere we want, and it doesn't matter if it fits in the model or not. We just bring it in, we create the relationships to where they need to go, and it takes a day to integrate a new data source."

- **Organizational knowledge.** In addition to external-facing models, interviewees reported that they also used Neo4j to provide insight into the organization itself. The principal architect, financial services, explained: "You can create an inventory of various systems that you have in the organization and how are they aligned with business goals and capabilities that the enterprise needs to have. And then you can build a graph where you have business goals and objectives, then you have nodes that are representing the systems that you have, and then you have a relationship. And imagine, when you have a new business initiative, you look for and immediately see the systems; you immediately know who to talk to."

FLEXIBILITY

The value of flexibility is unique to each customer. There are multiple scenarios in which a customer might implement Neo4j and later realize additional uses and business opportunities. All the interviewees reported that once they and their business stakeholders saw the power of working with Neo4j, they continued to discover new applications that deliver value to the organization.

"Neo4j has and continues to be a very good partner for us. Their technology is the leader of the pack, and they've been a tremendous partner to work with over the years. We were pushing some of the boundaries of what they offered back in those early days, and they were very receptive to taking our feedback and incorporating into the product."

Chief architect, not-for-profit

Analysis Of Costs

■ Quantified cost data as applied to the composite

Total Costs						
Ref.	**Cost**	**Year 1**	**Year 2**	**Year 3**	**Total**	**Present Value**
Dtr	Neo4j license and fees	$330,000	$330,000	$330,000	$990,000	$820,661
Etr	Neo4j administration	$73,500	$73,500	$73,500	$220,500	$182,784
	Total costs (risk-adjusted)	$403,500	$403,500	$403,500	$1,210,500	$1,003,445

NEO4J LICENSE AND FEES

Evidence and data. Neo4j Graph Data Platform is provided by Neo4j on an annual subscription basis. Neo4j license and fees are based on:

- The size and type of deployment.
- Support tier.
- Length of contract.

Modeling and assumptions. Forrester estimates the following for the composite organization:

- Subscription fees include license, support, and maintenance fees, which typically represent 85% to 90% of total investment.
- Professional services, which typically represent 10% to 15% of total investment.

Results. Because Neo4j fees are contractually agreed upon, Forrester did not apply a risk adjustment to costs, yielding a three-year total PV (discounted at 10%) of $821,000.

Neo4j License And Fees					
Ref.	**Metric**	**Source**	**Year 1**	**Year 2**	**Year 3**
D1	License and fees	Neo4j	$330,000	$330,000	$330,000
Dt	Neo4j license and fees	D1	$330,000	$330,000	$330,000
	Risk adjustment	0%			
Dtr	Neo4j license and fees (risk-adjusted)		$330,000	$330,000	$330,000
	Three-year total: $990,000		**Three-year present value: $820,661**		

NEO4J ADMINISTRATION

Evidence and data. The interviewees all reported that the maintenance of New4j is less onerous than the previous solution. The chief architect for a not-for-profit said, "On the operational side, I would say that we dedicate half an FTE to backups, version control, maintenance, patching, that kind of stuff."

Modeling and assumptions. The composite organization allocates 50% of an FTE's time to maintaining Neo4j.

Risks. Costs of Neo4j administration may vary due to:

- The annual cost of a data engineer.

- The frequency of updates, leading to more or less time spent by the data engineer.

Results. To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year, risk-adjusted total PV of $183,000.

Neo4j Administration					
Ref.	Metric	Source	Year 1	Year 2	Year 3
E1	FTE required to maintain Neo4j	Interviews	0.5	0.5	0.5
E2	Annual fully burdened salary of data engineer	Assumption	$140,000	$140,000	$140,000
Et	Neo4j administration	E1*E2	$70,000	$70,000	$70,000
	Risk adjustment	↑5%			
Etr	Neo4j administration (risk-adjusted)		$73,500	$73,500	$73,500
	Three-year total: $220,500		Three-year present value: $182,784		

Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)
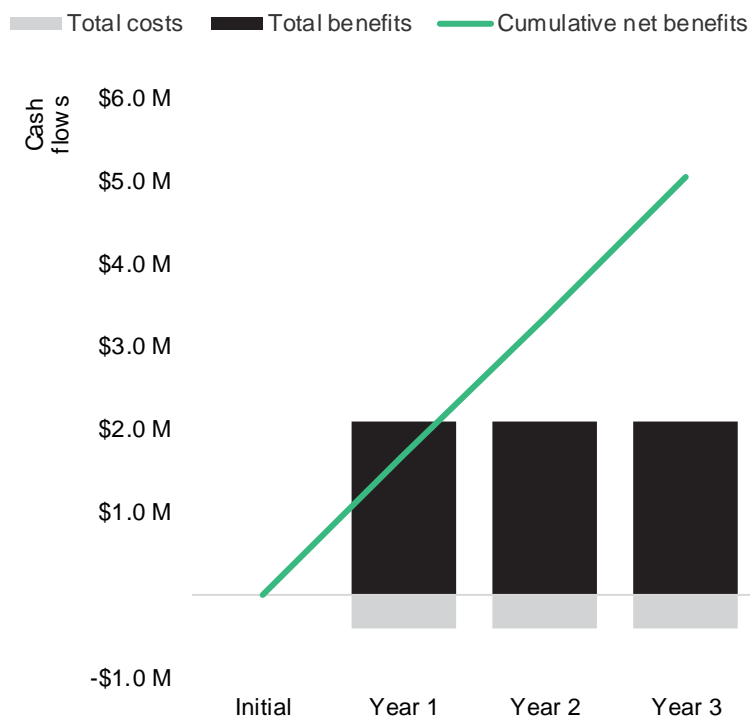
The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the composite organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.

These risk-adjusted ROI and NPV values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Analysis (Risk-Adjusted Estimates)						
	Initial	Year 1	Year 2	Year 3	Total	Present Value
Total costs	$0	($403,500)	($403,500)	($403,500)	($1,210,500)	($1,003,445)
Total benefits	$0	$2,085,100	$2,085,100	$2,085,100	$6,255,300	$5,185,335
Net benefits	$0	$1,681,600	$1,681,600	$1,681,600	$5,044,800	$4,181,890
ROI						417%

Appendix A: Total Economic Impact

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

TOTAL ECONOMIC IMPACT APPROACH

Benefits represent the value delivered to the business by the product. The TEI methodology places equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization.

Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.

Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.

Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.

PRESENT VALUE (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.

NET PRESENT VALUE (NPV)

The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.

RETURN ON INVESTMENT (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.

DISCOUNT RATE

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.

PAYBACK PERIOD

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Appendix B: Supplemental Material

Related Forrester Research
"The Forrester Wave™: Graph Data Platforms, Q4 2020," Forrester Research, Inc., November 16, 2020.

Appendix C: Endnotes

[1] Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

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