



Application Server Cost of Ownership

Oracle WebLogic Suite versus IBM WebSphere Application Server Network Deployment

PIQUE SOLUTIONS

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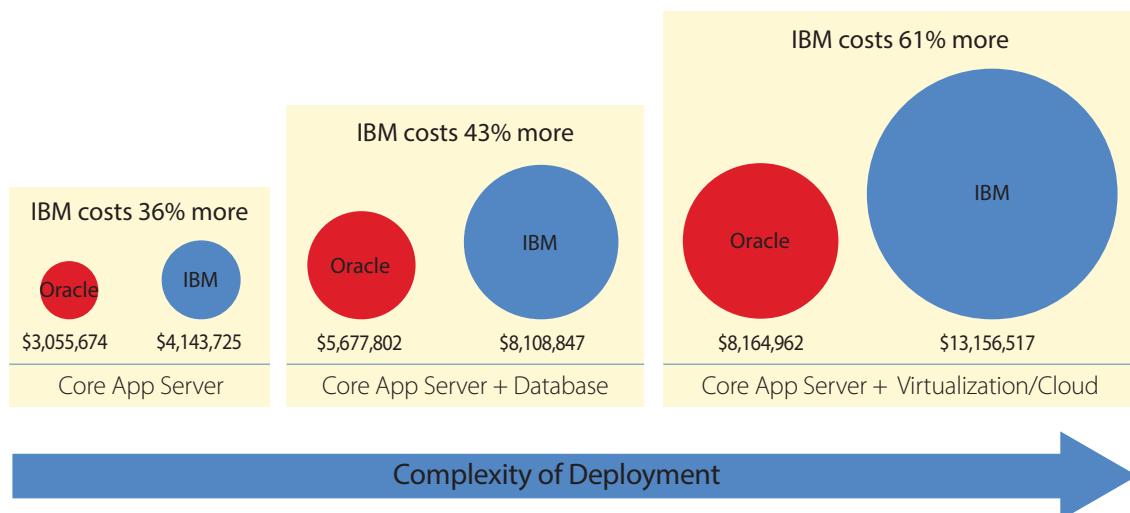
Executive Summary

Application server deployments are evolving in terms of capability requirements and the need to support larger scale in a cost-effective manner. An in-memory data grid, for example, was once considered an advanced deployment feature. It is now a foundational capability for data-intensive applications and, in a trend led by Oracle, bundled into application server suites. The advent of cloud computing, both public and private, has also raised the stakes for cost-effective scalability; cloud deployments introduce complexity because they are large, multitiered, densely clustered and highly virtualized. As complexity increases, so does the need to manage cost—in particular, the long-term cost of ownership.

Proper cost of ownership analysis includes cost elements through the complete application server life cycle. The productivity and efficiency of teams implementing and managing application server deployments are significant factors of total cost. The levels of productivity and efficiency are highly dependent on hardware and software architecture, the depth of solution integration and the surrounding management tooling.

Pique Solutions studied two leading enterprise application server platforms, Oracle WebLogic Suite 12c and IBM WebSphere Application Server Network Deployment 8.5, to understand the differences in long-term cost of ownership. The study involved a platform cost comparison and activity-based data collection from IT managers, directors and VPs experienced in buying, implementing, managing, and upgrading application server platforms.

**Figure 1. The Five-Year Cost Impact of Increasing Complexity and Scale:
Oracle WebLogic Suite vs. IBM WebSphere Application Server ND**



Summarized in **Figure 1**, the study results show that:

- ⊕ Over five years, WebSphere is 36% more costly than WebLogic. This comparison is based on similar application server deployments, with core capabilities including an in-memory data grid. The top reasons for the significant difference in cost are higher software cost, higher skill levels required and higher effort required for management and administration for IBM WebSphere. Study participants found WebSphere to be a less-unified platform than WebLogic with specific challenges having to integrate and use multiple components and consoles for life-cycle management.

- ⊕ Many study participants, including many WebSphere customers, were using Oracle databases as the back end for their business-critical applications. Integrating database connectivity and management increased environmental complexity, resulting in WebSphere being 43% more costly than WebLogic for that scenario. That cost increase was the result of multiple resources using disparate tools to accomplish combined application server and database activities.
- ⊕ When a larger cloud deployment with virtualization and clustering is analyzed, the study shows that the IBM WebSphere 43% “cost premium” grows nonlinearly to 61%. Again, as capability requirements grew, participants reported that complexity in the WebSphere solution resulted in lower productivity and efficiency, compared to WebLogic.

Introduction

Oracle WebLogic and IBM WebSphere represent two mature application server platforms for the enterprise. Both have a substantial customer base and a lengthy history of deployment. With each release, most recently WebLogic 12c and WebSphere 8.5.5, new capabilities are added to the core application server offerings. These capabilities are important in addressing the changing nature of application server deployments wherein there is deeper interaction among the elements of the application server suite.

As both product capabilities and application server deployments become more advanced, the level of complexity increases.

Figure 2. The Layers of an Application Server Deployment

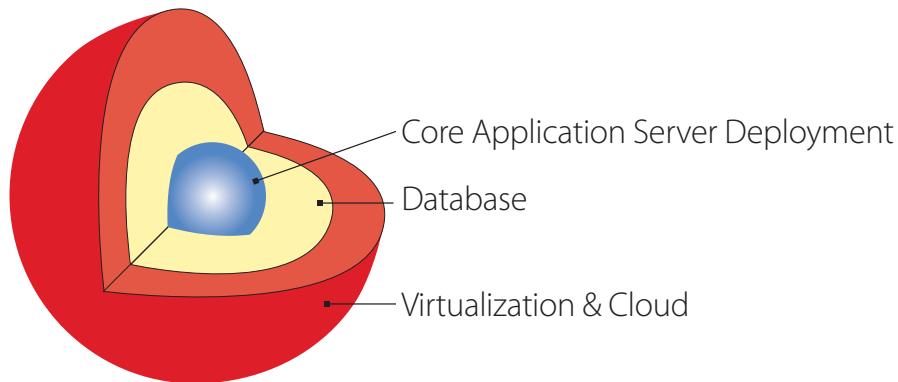


Figure 2 illustrates three relevant scenarios when discussing the cost of ownership of application server deployments:

- ⊕ **Core App Server:** The “core” application server deployment now commonly includes the application server, an in-memory data grid and management software.
- ⊕ **Core App Server + Database:** Most applications require a database to keep persistent data. The ability to take advantage of the native capabilities of the database in an application server is critical.
- ⊕ **Core App Server + Virtualization and Cloud:** Larger private and public cloud deployments rely heavily on clustering and virtualization and are highly elastic in nature so that they can scale up or down based on need.

It is important for IT executives and implementers to understand the cost of ownership implications for deployment scenarios with increasing scope and complexity. The cost profile in the core can grow exponentially as advanced capabilities are introduced to address advanced scenarios.

The differences in vendor platforms and solutions have a direct impact on the long-term cost profile throughout the application server life cycle. Such differences include the level of engineering and integration among elements of the application server platform, the capability and ease of use of the tooling included, the unified management capability, and even the development tools. All of these affect the level of productivity and efficiency of implementers, developers and administrators of application server platforms.

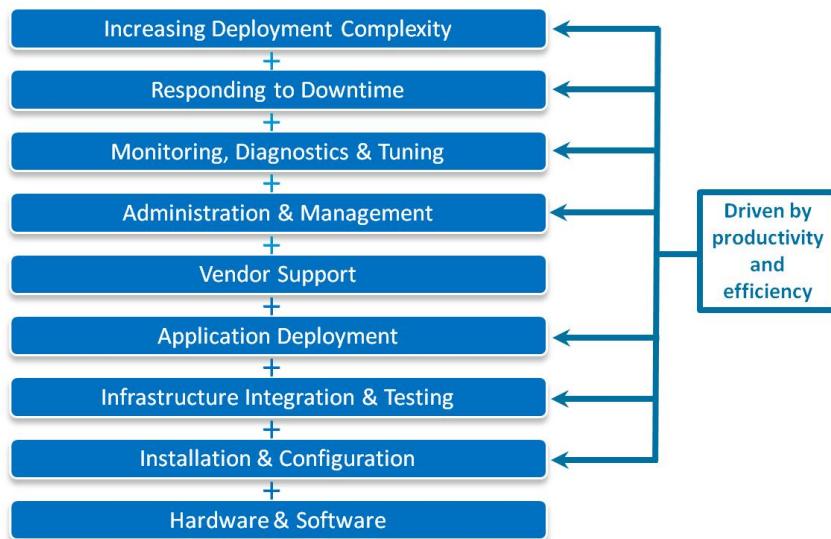
“IBM is more expensive across the board. It is more difficult to implement and it has a higher TCO than WebLogic, which we find more fluid, economical and scalable. We find Oracle WebLogic is much better suited to large-scale cloud deployments than IBM WebSphere.”

Vice President & Project Manager
Oracle and IBM Systems Integrator

A Five-Year Cost of Ownership Comparison

Pique Solutions' approach to cost of ownership seeks to highlight major cost areas, focusing in particular on those areas where there are substantive differences between application server platform alternatives. Pique employs a framework that includes key cost categories over the life cycle of an application server infrastructure deployment. The categories are listed in **Figure 3**. All but two of them involve labor cost, which is highly dependent on the productivity and efficiency of the teams involved. As complexity is added to the deployment, in terms of either capability or size, the cost impact of productivity and efficiency can lead to nonlinear cost increases.

Figure 3. Cost of Ownership Analysis Elements



Research Methodology

The first step in the research involved a comparison of pricing of each vendor's platform including licensing for application server suites along with any management tools required in each environment.

The second step was a primary research phase consisted of an in-depth, multiphase data collection and interviews conducted with 16 companies. Roles of the interviewees included IT VPs, IT directors, development managers and operations managers. The research process involved an initial screening to confirm the companies' usage of the relevant Oracle and IBM products and the interviewees' ability to fully respond to cost and business value questions. For companies that passed the screening, an initial interview took place to capture the following data:

- ⊕ Company type
- ⊕ Application server workloads
- ⊕ Size of application server deployments (servers, CPUs, application server instances)
- ⊕ Type(s) of development projects
- ⊕ Number of developers and administrators

After the interview, each company received a detailed data-collection instrument that contained 70 unique, quantitative data elements, along with a provision for qualitative descriptions of the responses. The questions and entries spanned the life cycle of the deployment from purchase to major upgrade

cycle. Of the 16 companies interviewed, eight companies provided complete data sets. Four of the companies provided direct comparative data for deployments of both WebLogic and WebSphere, two provided data for WebLogic and two provided data for WebSphere. Industries represented include financial services, technology, educational services, government, media, health care and business services. The composite profile used for the cost of ownership analysis, based on all of the companies interviewed in the study, is provided in **Table 1**.

Table 1. Composite Profile for Cost of Ownership Analysis

164 physical application servers (hosts)
4 CPUs/server
3.5 application server instances per host
32 unique application(s) modules served (custom, packaged, etc.)
2,900 end users of applications
13.1 full-time developers/architects
3.4 full-time administrators

Comparing the Cost of the “Core” Application Server Deployment

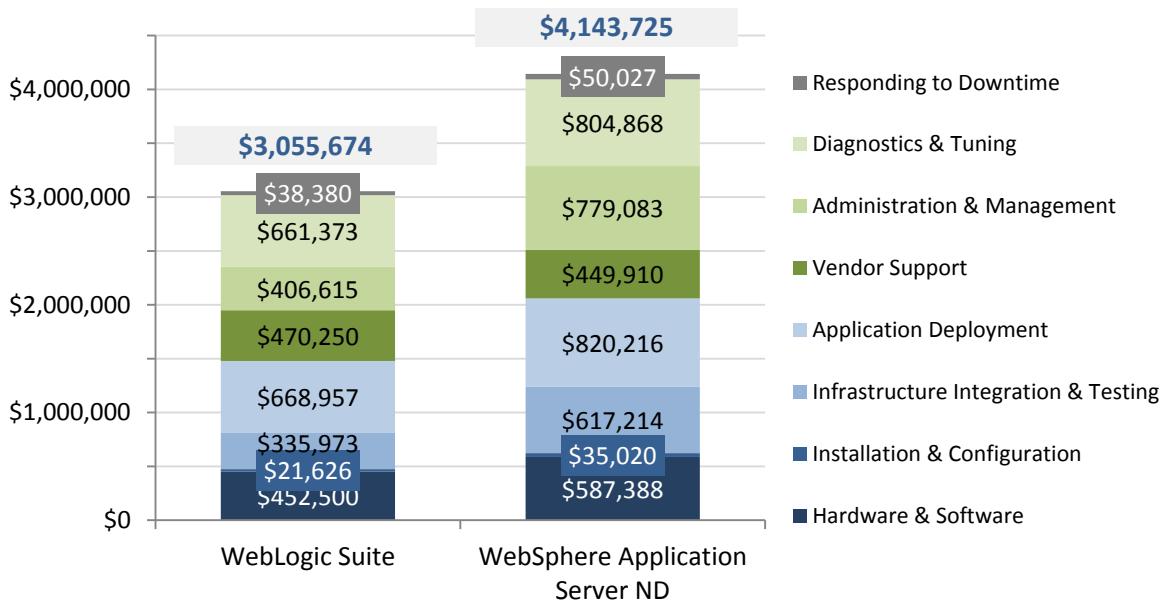
This section defines the baseline comparison of cost for the core deployment, including:

- ⊕ Application servers
- ⊕ Management tools
- ⊕ In-memory data grid
- ⊕ Real-time environment

This section analyzes the cost of ownership over five years of modest-size deployments of five physical application servers, with apples-to-apples hardware and software configurations. Each server has two dual-core processors and hosts an average of four virtual application servers.

Figure 4 presents the *pro forma* costs for the deployment scenario for the core application server configurations. The acquisition and ongoing support costs reflect current list prices, less an average discount of 25%, while the labor costs for implementation, deployment, testing, administration and management are based on the primary research data collected. All costs are listed in US dollars.

Figure 4. Five-Year Cost Comparison by Life Cycle Element



Hardware and Software

WebLogic cost is \$452,500 vs. \$587,388 for WebSphere; WebSphere is 30% higher.

The hardware cost for both vendors is the same, based on a total of five servers, each configured with two dual-core Intel processors for a total of 20 cores.

The cost of licensing the WebLogic software required for the environment includes the license for WebLogic Suite (list price of \$45,000 per core) and for WebLogic Management Pack EE (list price of \$12,000 per core). The total list price is \$57,000 per core. WebLogic is licensed on a core-factor basis, with Intel processors having a factor of 0.5. Based on that pricing and with a discount of 25% factored in, the total software license fee for WebLogic is \$427,500.

Calculating software license fees for WebSphere is slightly more complex because IBM has two types of core-based pricing: Resource Value Unit (RVU) and Processor Value Unit (PVU). RVU pricing is based on the number of cores in the deployment, and PVU pricing is based on the number of cores in addition to a scaling factor that takes into account the server/processor type. In order to perform an apples-to-apples comparison with WebLogic, it is necessary to factor in many individual WebSphere components that must be licensed separately. These are listed in **Table 2**.

As indicated in **Table 2**, the total list price per core for WebSphere is \$37,493. Based on the 20 cores in the deployment and factoring in a discount of 25%, the total software license fee for WebSphere is \$562,388. IBM does include the first year of support in the license fee.

Table 2. IBM Software Components for Core Application Server Analysis

Line Item	Resource Value Unit Price/Core	Processor Value Unit	Total/Core (Based on 100 PVUs Per Core)
IBM WebSphere Application Server Network Deployment		\$196	\$19,600
IBM WebSphere Real Time		\$85.75	\$8,575
IBM Tivoli Composite Applications for Application (ITCAM) Diagnostics	\$7,936		\$7,936
IBM Tivoli Application Dependency Discovery Manager	\$28		\$28
IBM Tivoli Composite Application Manager for Transactions for Client Response	\$376		\$376
IBM Tivoli Asset Discovery for Distributed		\$0.295	\$29.50
IBM Tivoli Provisioning Manager	\$490		\$490
Total			\$37,493

Installation and Configuration

WebLogic cost is \$21,626 vs. \$35,020 for WebSphere; WebSphere is 62% higher.

For basic installation, which includes the application server, management tools and back-end database connection, the costs for WebLogic and WebSphere were even, in terms of skill-adjusted effort. That said, study participants cited a significant difference in the installation of the in-memory data grid software, with Oracle Coherence taking 50% less time than IBM WebSphere eXtremeScale. For configuration related activities, WebLogic required on average 48% less effort for overall configuration across the application server and in-memory data grid, including basic configuration, clustering, and the database. Study participants found that the numerous Tivoli tools required additional time to configure among the application server and database tiers. Specifically, each component required its own unique configuration settings.

Infrastructure Integration and Testing

WebLogic cost is \$335,973 vs. \$617,214 for WebSphere; WebSphere is 84% higher.

Study participants said that the effort and cost associated with integration and testing were significantly different for WebLogic and WebSphere. While the effort for testing was similar, there was a very large difference in the level of effort and skill required for integration. As a result, WebLogic cost over 51% less. Specifically, study participants cited 35% less effort and time for **integration with other middleware components** and 60% less effort and time for **integration with existing infrastructure and applications**. A vice president of engineering for an education services company found, “Integration is the most challenging for WebSphere due to the

“Integration is the most challenging for WebSphere due to the number of individual software components, interoperability issues and the need to customize to work with our existing infrastructure.”

VP Engineering, Global Operations & Infrastructure
Education Services

number of individual software components, interoperability issues and the need to customize to work with our existing infrastructure.” The skill level required for integration and testing was higher on average for WebSphere than for WebLogic: 0.9 versus 1.17, respectively. This expertise premium led several companies in the study to bring in IBM professional services to assist with the infrastructure integration.

Application Deployment

WebLogic cost is \$668,957 vs. \$820,216 for WebSphere; WebSphere is 23% higher.

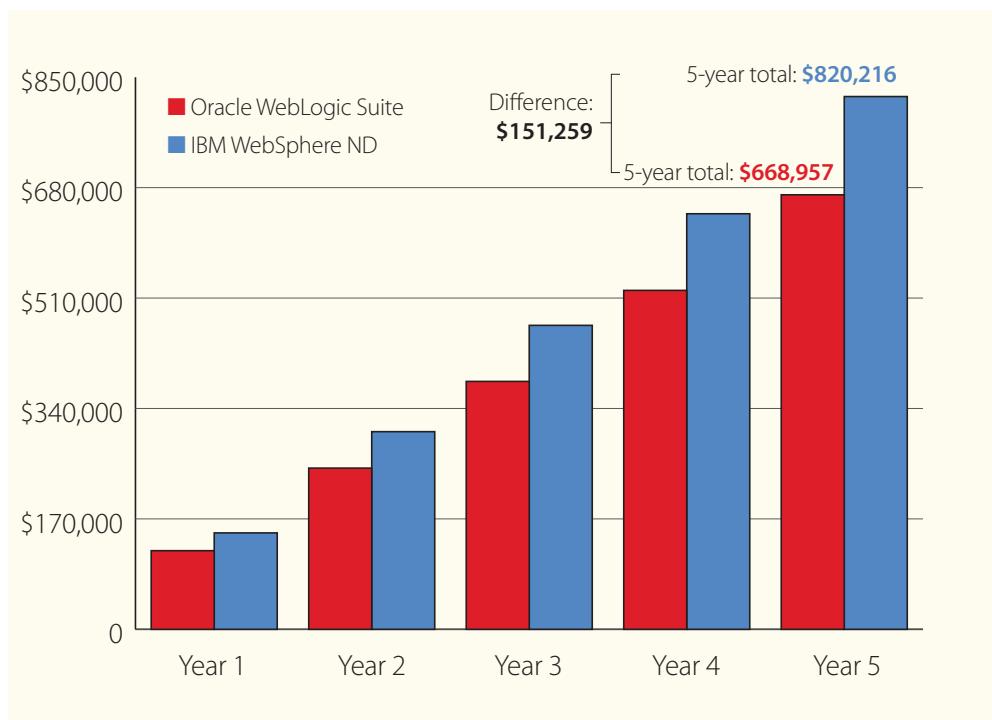
Application deployment includes both developer and administrator time for deploying applications to production environments. As application development is a continuous process, the effort and cost for deployment is ongoing in each year. Study participants indicated fairly similar effort and cost for administrators deploying applications but did identify a significant time savings for developers in deploying applications on WebLogic. On average, study participants cited a savings of over 40% because of easier-to-use tools for moving and versioning applications across more complex environments, including dev, test, staging and production nodes. The average skill index for WebLogic for application deployment was 0.75 versus 1.15 for WebSphere, validating what the research participants said in interviews. A VP of operations for a business services company related, “With WebLogic, it is easier for our development teams deploying applications. It doesn’t require scripting or a highly advanced skill set.”

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VP, Operations

Business Services

Figure 5. Cumulative Five-Year Cost Comparison of Application Deployment

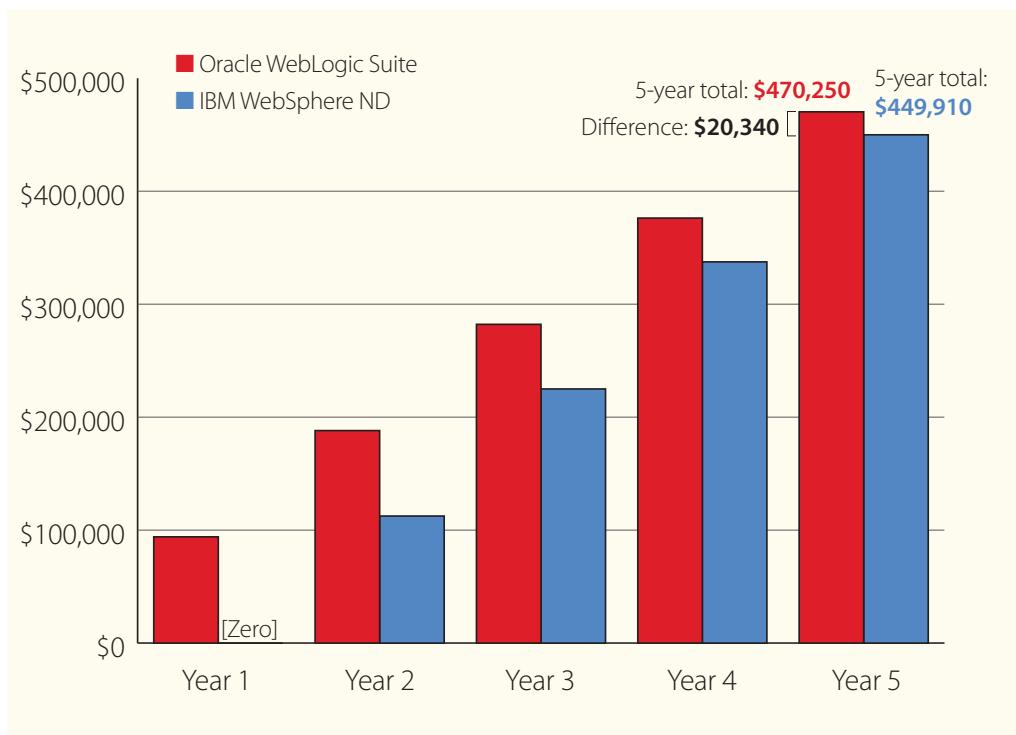


Vendor Support

WebLogic five-year cost is \$470,250 vs. \$449,910 for WebSphere; WebSphere is 4% lower.

The vendor support fees are a function of the software license; both Oracle and IBM charge an annual support fee to provide product updates/upgrades, vendor support and premium access to support content. Oracle's support fees are slightly higher than IBM's: 22% versus 20% of the software price per year, respectively. However, IBM includes support fees in the software license for the first year. In years two through five, vendor support fees are higher yearly for WebSphere due to the higher cost of the IBM software license. The difference in cost in the first year largely explains why the IBM support costs are lower over the five-year period.

Figure 6. Cumulative Five-Year Cost Comparison of Vendor Support



Administration and Management

WebLogic five-year cost is \$406,615 vs. \$779,083 for

WebSphere; WebSphere is 92% higher.

Administration and management consists of a broad array of activities for application server administrators. It represents an area of significant depth in the study and an area where there was a considerable difference between WebLogic and WebSphere. Study participants provided time and effort estimates for 20 activities among the application servers and in-memory data grid servers. There was a consistent and considerable advantage for WebLogic, with 36% lower cost for application servers and 59% lower cost for in-memory data grids. The compelling factor was a fundamental difference in the tooling between the environments. Study participants identified

“Enterprise Manager is a single product that manages the database, middleware and apps all in one place. It allows us to simplify and automate pretty much everything we need to do.”

Director, IT

Health Care Organization

Oracle Enterprise Manager's WebLogic Server Management Pack Enterprise Edition and other Enterprise Manager feature, as having a much more unified management capability. This included the ability to manage easily across application, application server and database tiers.

An IT director for a health-care company related, "[Oracle] Enterprise Manager is a single product that manages the database, middleware and apps all in one place. It allows us to simplify and automate pretty much everything we need to do." Study participants also cited the ease of patching and updates as an area that simplified ongoing operations.

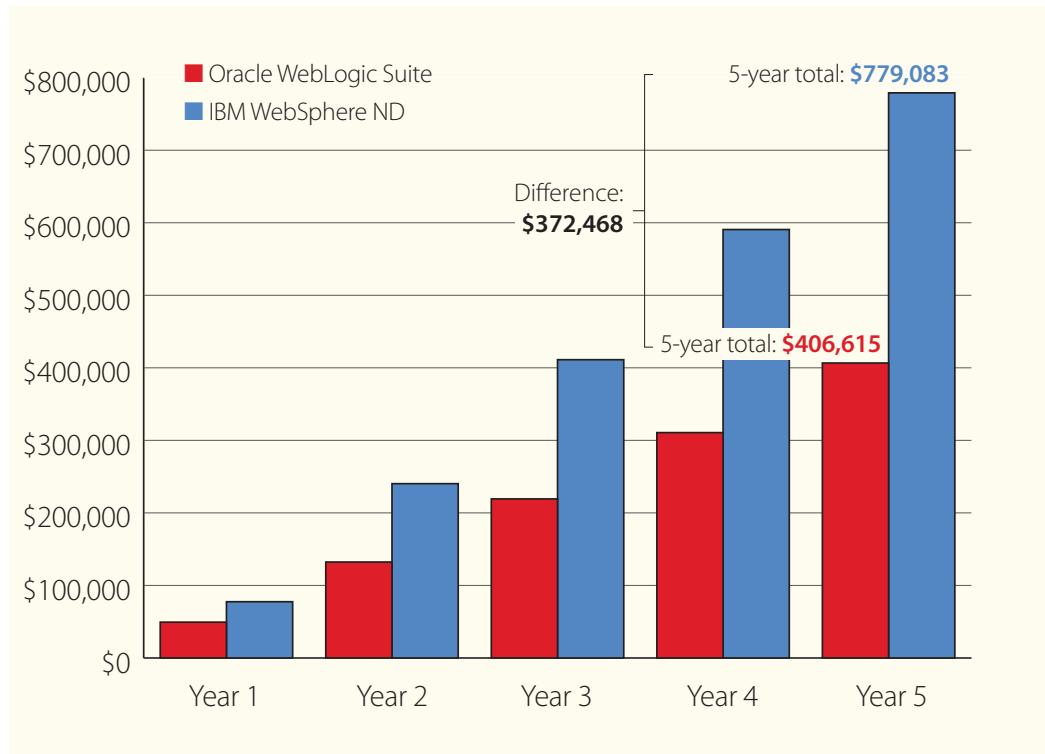
On the contrary, most IBM participants used Tivoli to manage their infrastructure. Participants found this tool very comprehensive but challenging to implement and compartmentalized in its use. In the words of a vice president of a systems integrator, "Tivoli is a bear to implement." Finally, study participants cited a big difference in the skill level required in the IBM environment and found activities in WebLogic to be much easier and more productive overall. As a result, many WebSphere customers tend to engage IBM Global Services to perform more advanced administration activities, resulting in escalating costs.

"Tivoli is a bear to implement."

VP and Project Manager

WebSphere and WebLogic Systems Integrator

Figure 7. Cumulative Five-Year Cost Comparison of Administration and Management

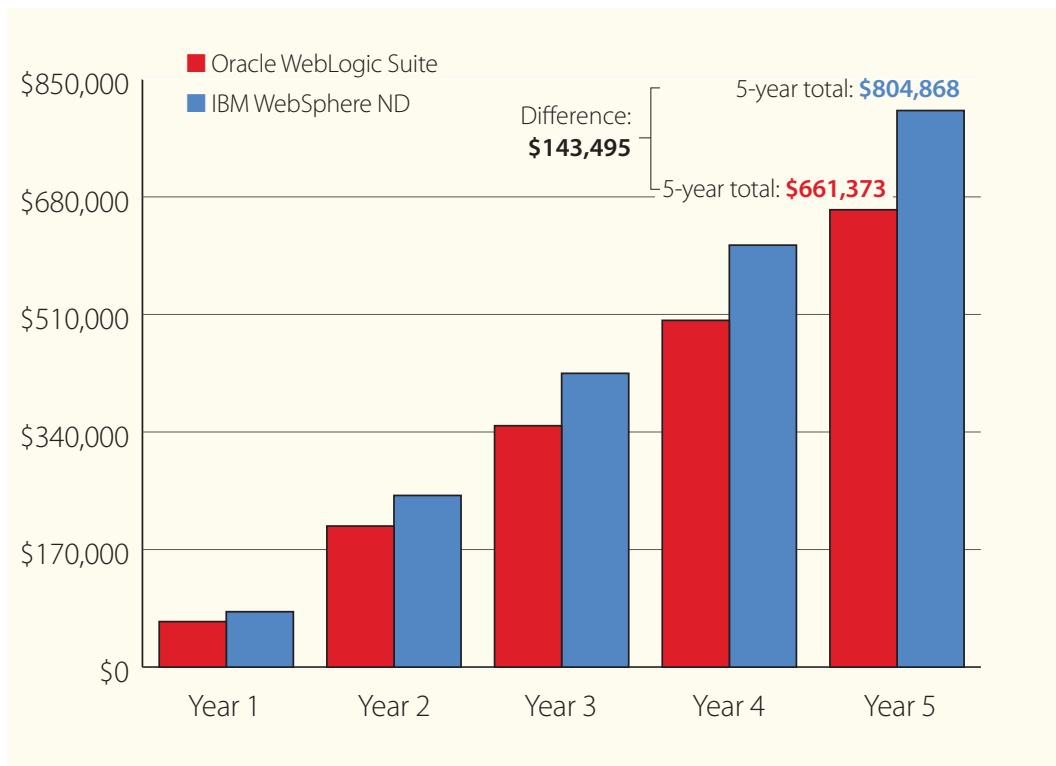


Monitoring, Diagnostics and Tuning

WebLogic five-year cost is \$661,373 vs. \$804,868 for WebSphere; WebSphere is 22% higher.

Monitoring, Diagnostics and Tuning consists of 12 key activities between the application server and in-memory data grid. The values for skill-adjusted effort between the two platforms were much closer than the values for administration and management, which suggests more parity in the diagnostic capabilities of WebSphere and WebLogic. Study participants cited a time and effort advantage for WebLogic of 8% in overall monitoring, diagnostics and tuning for the application server, but that jumped to 28% for the in-memory data grid servers. The activity requiring the most effort—and where there was the largest difference between WebLogic and WebSphere—was **diagnosing performance problems and determining where the performance bottleneck lies**. While Oracle Enterprise Manager's JVM Diagnostics can detect and diagnose Java-related problems and bottlenecks without any instrumentation, IBM's Java Diagnostics relies on elaborate, byte-code instrumentation (BCI) requiring significant, up-front effort from the system administrators.

Figure 8. Cumulative Five-Year Cost Comparison of Monitoring, Diagnostics and Tuning Costs



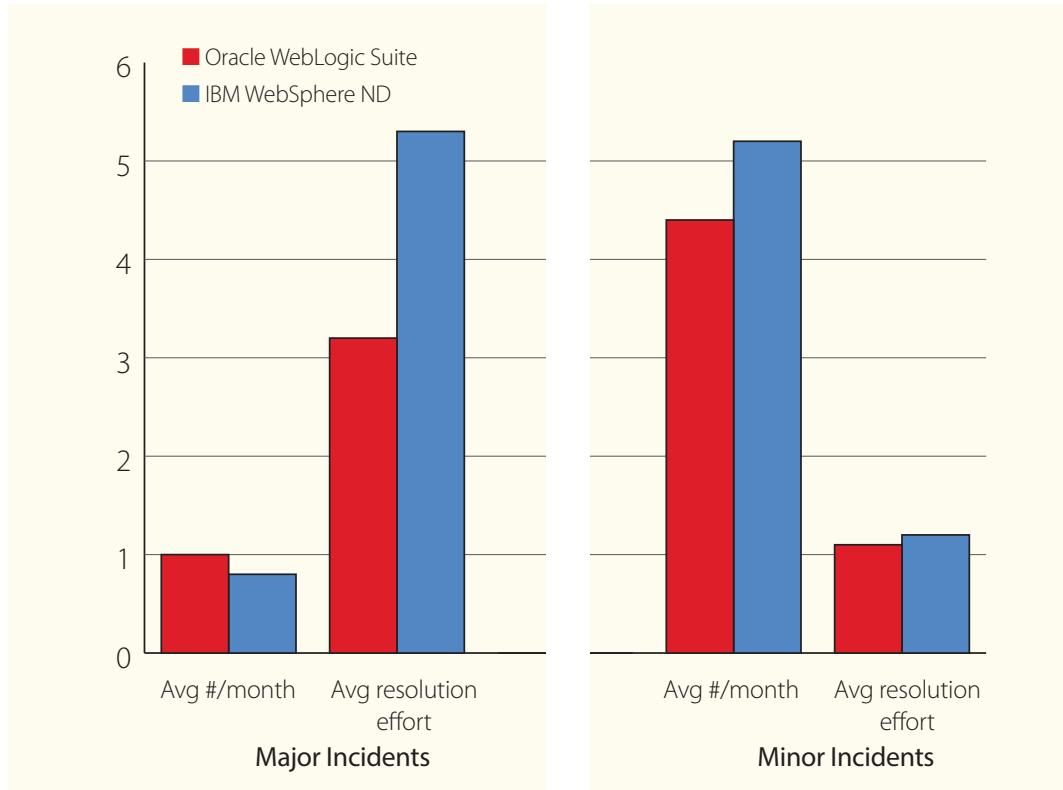
Responding to Unplanned Downtime

WebLogic five-year cost is \$38,380 vs. \$50,027 for WebSphere; WebSphere is 30% higher.

Beyond the regular administrator activities, the Pique study explored the impact of unplanned downtime. The study found that nearly all involved deployments included clustering and failover, meaning that downtime very rarely resulted in adverse cost effects from lengthy user outages. Rather, the cost of ownership impact involved the response required by administrators to resolve major and minor downtime-related incidents in the application server deployments.

As **Figure 9** shows, for major incidents, WebSphere has a slightly lower incidence rate but a substantially higher resolution effort. WebLogic has fewer minor incidents, and the effort to resolve both major and minor incidents is lower.

Figure 9. Responding to Unplanned Downtime (resolution effort in hours)



Beyond the Core: The Cost Impact of Database and Cloud Scenarios

For a core application server deployment including an in-memory data grid, study participants reported that WebLogic yielded significant cost savings in all areas of the application server life cycle, with the exception of vendor support costs. The other deployment scenarios that Pique studied—including database-intensive deployments and large cloud-based deployments—demonstrated even greater cost savings. In fact, Pique found that as the deployment increased in complexity, the difference in cost increased in a nonlinear fashion, in large part because WebLogic implementers, developers and administrators enjoyed higher productivity and efficiency than did their WebSphere counterparts.

Native Database Scenario

The study found that those participants using WebLogic in conjunction with a database were using Oracle as the back end. In fact, Oracle databases were even used in a few of the participants' IBM WebSphere environments. Participants cited advantages in deploying a unified application server and database environment, particularly so on the Oracle side. They pointed out that they were able to use Oracle Enterprise Manager to manage—in a unified environment—the entire life cycle of WebLogic and Oracle Database, including testing, provisioning, patching, configuration management, change management, diagnostics and tuning. The resulting gains in productivity and efficiency were significant. The study participants also mentioned Oracle WebLogic Server Active GridLink for Oracle Real

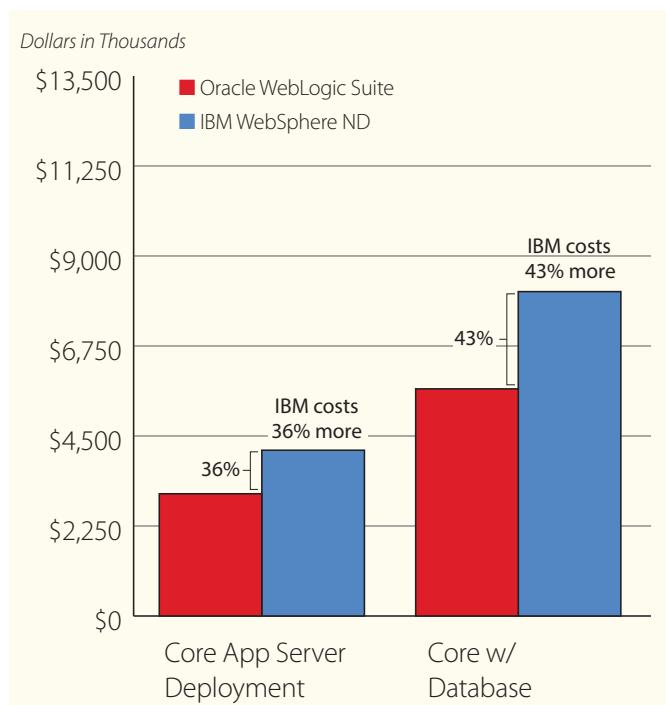
Application Clusters (RAC) as a key benefit of using WebLogic in conjunction with Oracle Database. Some study participants were in the process of implementing the Oracle Database Appliance (ODA), which offers preconfigured and integrated servers that drive further savings in labor cost.

Regarding the IBM deployments with WebSphere and third-party (Oracle) database, study participants cited complexity in managing the various elements of the heterogeneous stack. They found that while IBM provides some database administrative tools, they had to go to third-party vendors for in-depth management functionality such as diagnostics, tuning and database workload testing. They found that they had to spend a significant amount of time in dealing with multiple vendors, performing integration testing and addressing compatibility issues.

A principal of operations and resource management for a technology provider said, "We use Tivoli to manage our WebSphere application server. Since we are using Oracle database, it is a separate team that manages the database. In fact, we have three separate teams that manage our application server stack with three separate tools." Such environments increase the effort required by various resources, heighten the need to coordinate across IT teams and introduce potential delays.

When expanding beyond the core application server deployment and accounting for the additional complexity of disparate database instances, the cost premium for WebSphere over WebLogic jumps from 36% to 43%, as **Figure 10** shows. This is due largely to the additional labor cost associated with using separate tools to independently manage different elements of the stack.

Figure 10. Adding Complexity: WebSphere Cost Premium over WebLogic for Database Scenario



Virtualization and Cloud

The third deployment scenario in Pique Solutions' research was a large cloud deployment. This scenario was significantly larger in scope and more complex, having an increase in the number of physical servers and a higher density of virtual application servers. The clustering in these deployments is more advanced, often with multi-site clustering to provide support for disaster recovery.

In terms of software, those running Oracle WebLogic had to license the Cloud Management Pack for Oracle Fusion Middleware for Oracle Enterprise Manager Cloud Control 12c. This pack provided the capabilities for setup, self-service provisioning of assemblies, self-service provisioning of Java apps, metering and chargeback, middleware as a service and cloud APIs. The Cloud Management Pack for Oracle Fusion Middleware has a list price of \$5,000 per core.

For WebSphere, several software components were required for the cloud deployments, including IBM SmartCloud Orchestrator, IBM WebSphere Virtual Enterprise Controller and IBM WebSphere Virtual Enterprise Node. In several cases, IBM Workload Deployer was also required. The Virtual Enterprise Controller and Workload Deployer are licensed based just on the hardware processors they run on, while the remaining software is licensed based on the broader application server deployment environment.

Table 3. IBM Software Components Added for Cloud Deployment

Line Item	Resource Value Unit Price/Core	Processor Value Unit	Total/Core (Based on 100 PVUs Per Core)
IBM SmartCloud Orchestrator	\$656		\$656
IBM WebSphere Virtual Enterprise Controller		\$156	\$15,600
IBM WebSphere Virtual Enterprise Node		\$94.50	\$9,450
IBM Workload Deployer		\$213	\$21,300

These large cloud deployments exacted a premium for manageability and scalability, and participants cited the value of Oracle capabilities such as Oracle VM and Oracle Virtual Assembly Builder (OVAB) in saving them time and cost. For IBM WebSphere, the lack of unified virtualization management capability magnified the cost challenges that plagued the core deployments. Few study participants were using IBM capability such as Workload Deployer in conjunction with the WebSphere Application Server Hypervisor Edition, citing the challenges and difficulty in using the capability. This was particularly true for participants who maintained more heterogeneous database environments.

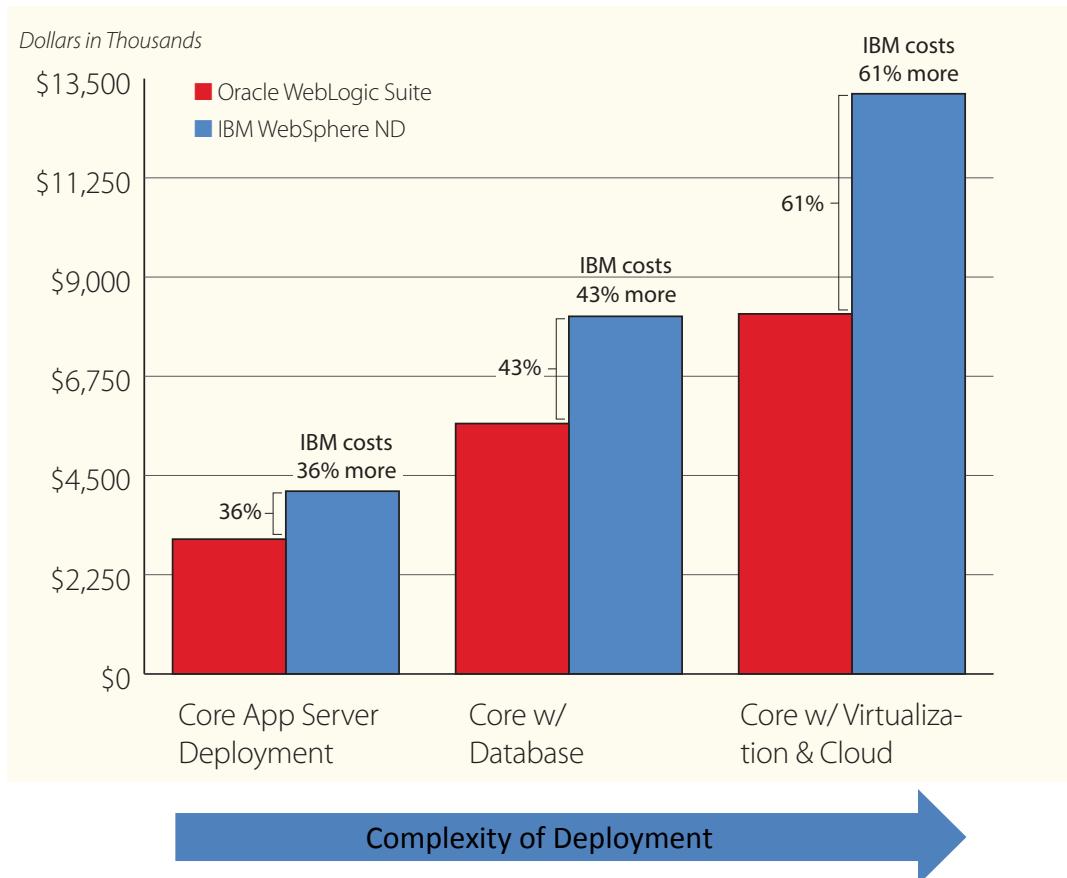
One study participant, an IBM systems integrator for the financial services industry, was actually using VMware combined with manual processes to achieve the IBM WebSphere virtualization. He related, "We don't use Workload Deployer because it doesn't suit most of our customer environments and, where we have trialed the capability, we found it did not meet our expectations."

"We find Oracle WebLogic is better suited to large-scale cloud deployments than IBM WebSphere."

Vice President & Project Manager
Oracle and IBM Systems Integrator

A vice president and project manager for a systems integrator, who is experienced with active deployments of both WebLogic and WebSphere, related the advantages of WebLogic over WebSphere in very large cloud projects, saying, “We are using WebLogic for a Global Cloud deployment. It provides us scalability and security for this very large-scale, high-visibility, health-care project with the federal government. We find Oracle WebLogic is better suited to large-scale cloud deployments than IBM WebSphere.”

Figure 11. Adding Complexity: WebSphere Cost Premium over WebLogic for Larger Cloud Scenario



Using its cost of ownership model to analyze a larger-scale deployment with a higher density of virtualization and additional complexity, Pique Solutions found that the cost of ownership “premium” for WebSphere jumps from 43% to 61% higher than WebLogic, as shown in **Figure 11**.

Conclusion and Key Takeaways

It is clear after interviewing and collecting data from many experienced managers and implementers of Oracle WebLogic and IBM WebSphere that both platforms are well suited to enterprise-class, business-critical application workloads. In fact, one area investigated as part of the study was the impact of downtime. In that area, the study results were similar in terms of the number of major and minor incidents that occurred on a monthly basis. Overall, there was very little downtime. While there were occasional anecdotes about adverse performance, such as production run-time issues with the IBM JDK, on the whole both vendors offer application servers that perform well for demanding workloads.

That being said, the study did highlight some fundamental differences in product philosophy, overall architecture and tooling that create serious cost implications for enterprise customers. There is no question that application server deployments, and the associated requirements, are becoming more complex. In this environment of increasing complexity, application server vendors and their platforms should not be adding to the complexity. Rather, enterprise customers should benefit from solutions that actually address and reduce complexity throughout the application server life cycle. A comparison of Oracle and IBM in terms of solution packaging, integration and a unified user experience reveals that Oracle WebLogic Suite, with Oracle Enterprise Manager's packs for WebLogic Server and Cloud management, is easier and less costly than IBM WebSphere to buy, implement, use and manage for enterprise customers.

Below is a summary of the key findings from the study.

For the core application server deployment, the cost profile of Oracle WebLogic Suite is lower than that of IBM WebSphere Application Server ND. This study finds that WebSphere is 36% more costly than WebLogic over five years. In fact, with the exception of vendor support, where the IBM cost is lower, the IBM WebSphere cost is higher in each of the cost categories through the application server life cycle.

WebLogic is easier to implement, operate and manage. Study participants cited a more unified product offering, less integration required, and management and administration tools that are much easier to use. As a result, the skill level requirements are significantly less in the WebLogic environment compared to WebSphere, and study participants cited a higher level of productivity and efficiency. A VP of operations for a business services company related, "WebLogic is easier to use and easier to get up-to-speed on. We have saved considerable amount of money because it doesn't require a niche or advanced skill set."

The WebLogic cost of ownership advantage grows non-linearly as deployment size and complexity increases. The significant IBM WebSphere cost premium of 36% for the core application server deployment grows nonlinearly as additional complexity is added in terms of capability and scale. For a database scenario, the cost premium grows to 43%, and for a large scale cloud deployment it increases to 61%. The primary reason for this, according to study participants, is that as requirements expand, so do the number of IBM or third-party components that need to be added to the solution. This affects cost throughout the entire application server life cycle, most notably the cost of software licensing, Infrastructure integration, and management and administration. As complexity increases, the levels of productivity and efficiency have a greater impact on cost of ownership.

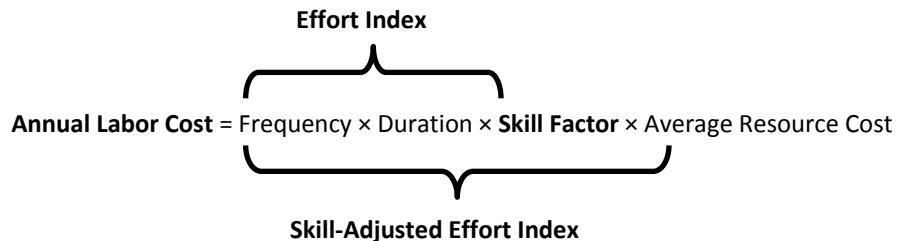
"WebLogic is easier to use and easier to get up-to-speed on. We have saved considerable amount of money because it doesn't require a niche or advanced skill set."

VP, Operations
Business Services

Appendix A: Estimating Labor Cost Using Skill-Adjusted Effort

The annual cost of managing an application server platform is the sum of the individual costs incurred for each activity. To estimate these individual costs, Pique collected the following information for each activity:

1. Frequency (times per year)
2. Duration (hours)
3. Skill factor: administrator skill (high = 1.5, medium = 1.0, low = 0.5)



Using this information, Pique calculated the yearly cost of management for each activity:

- ⊕ *Effort index* represents the total hours spent on an activity in one year.
- ⊕ *Skill factor* normalizes these hours to correspond to a medium- or average-skilled administrator. For example, if a task requires 100 hours per year by a highly skilled administrator, that corresponds to 150 hours for a medium-skilled administrator.
- ⊕ *Skill-adjusted effort* is the effort index, adjusted by the skill factor, to give the total number of hours required for the activity in one year by an average administrator.

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