



Anàlisi de solucions més populars de *Business Intelligence*

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Pla d'estudis: Grau Enginyeria Informàtica

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FITXA DEL TREBALL FINAL

Títol del treball:	Anàlisi de solucions més populars de <i>Business Intelligence</i>
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Resum del Treball (màxim 250 paraules):	
<p>En aquesta memòria de final de grau, es pretén donar la informació necessària de recerca en relació a les eines Business Intelligence en les quals podria estar interessada qualsevol persona i/o empresa que vulgui posar en funcionament dins la seva empresa una eina d'anàlisi d'aquest tipus.</p> <p>Es fa una introducció al Business Intelligence i llavors es pot trobar la informació relativa a cadascuna de les eines seleccionades de millor acceptació en l'actualitat.</p> <p>La recerca es centra en les solucions Open Source i podem trobar una descripció de cadascuna de les eines i finalment trobareu una comparativa segons les avaluacions actuals per poder determinar quina pot ser la millor eina a implantar.</p>	

Abstract (in English, 250 words or less):

In this final degree report, it is pretended to give all the needed information regarding to Business Intelligence tools in which anyone or any company could be interested to implement into his enterprise an analysis tool like this.

First of all, there is an introduction to Business Intelligence. Then you can find all the information related to each of the selected tools with a wider acceptance at the moment.

The research is focused on Open source solutions. You can find a description for each solution and a comparison according to the current appraisals in order to determine which would be the best tool to implement.

Paraules clau (entre 4 i 8):

Business Intelligence, Eines, OLAP, ETL, dashboard, datamart, BI tools, Data mining

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1. Introducció

1.1 Context i justificació del Treball

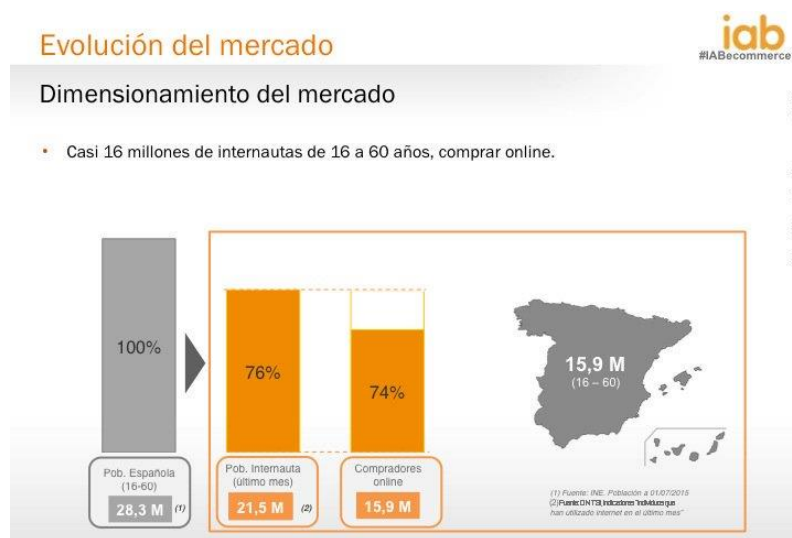
Actualment, vivim en una societat on la informació es preveu molt valuosa i requereix esforços econòmics i físics per obtenir-la. A més, la rebem des de moltes vies les més tradicionals serien la televisió, emissores de ràdio, publicitat entre altres i ja des de fa molts anys també la rebem a través de les xarxes socials que han pres gran importància en les nostres vides.

S'han fet estudis de com es fan servir aquestes xarxes socials en el nostre dia a dia i segons l'informe que va realitzar IAB Spain sobre l'ús de les mateixes durant l'any 2016 sabem que a Espanya un 81% dels internautes d'edats compreses entre 16 i 55 anys les utilitzen, és a dir, hi ha uns 15 milions d'usuaris que en fan un ús continuat. A més, s'observa que les aplicacions més utilitzades són Whatsapp i Facebook encara que la darrera no és de les millors valorades.

Continuem analitzant les estadístiques realitzades per IAB Spain i Elogia, en concret, ara veurem com ha variat l'estil de compra dels espanyols i com actualment hi ha més gent que realitza les seves compres a través de plataformes eCommerce.

Observant el gràfic de la il·lustració 1, podem dir que un 74% dels usuaris d'Internet a Espanya realitzen compres a través d'Internet, això suposa un increment d'un 8% respecte l'any anterior i per tant es confirma l'evolució de la implantació del comerç electrònic a Espanya.

El perfil d'aquets consumidors són persones d'uns 38 anys, amb estudis universitaris(65%) i que fan ús de les xarxes socials(98%).



Il·lustració 1: Evolució eCommerce

A Internet es genera una multitud de dades i saber tractar aquesta informació no és del tot fàcil i requereix unes eines precises i en ocasions personal que estigui ben format i és aquí que l'ús de sistemes d'intel·ligència de negoci (BI) ens ajuden a prendre decisions de forma més eficient.

Arribats a aquest punt podem veure clarament la necessitat de les empreses per ser presents a la xarxa i per fer ús de tota la informació que es pugui treure d'elles com a base principal, es fa necessari llavors, canviar els clàssics sistemes estadístics d'anàlisi que usen actualment moltes d'elles per sistemes més eficients i moderns.

Per tant, aquesta nova necessitat implica afegir nous sistemes de treball i noves eines d'anàlisi que permeti a les empreses ser coneixedores dels canvis i preferències dels consumidors, per així, poder orientar les seves produccions als nous desitjos dels clients i poder ser millor competidors.

Les eines BI són innovadores i van entrant a les empreses d'una forma bastant ràpida degut a la necessitat de tractar la informació de la manera més ràpida possible i això permetrà obrir noves possibilitats de negoci amb la creació de nous productes, o bé, la de realitzar campanyes de publicitat segmentades, generar promocions als clients segons la fidelitat dels mateixos amb les empreses i la realització de campanyes de màrqueting orientades per tal d'aconseguir major benefici i menys inversió i així poder donar millor qualitat de servei i incrementar els ingressos.

Arribats a aquest punt, el projecte pretén primer fer una introducció del que significa Business Intelligence, explicant breument, les diferents fases per el que les dades han de circular abans de poder-ne observar els resultats.

En segon lloc, s'analitzaran diferents eines BI, en concret, es treballaran les que s'han estimat més importants actualment per les empreses per tal d'extreure coneixement dels diferents processos de l'empresa. Per tant, es farà una recerca d'aquestes eines per veure quines es poden seleccionar per a procedir-ne al seu estudi. Es donarà especial atenció a les eines de llicència gratuïta tot i que no es descarten les de llicència privada on llavors es detallaran els costos de les mateixes.

Per acabar, trobareu una comparativa de les diferents eines estudiades segons el que s'ha observat prèviament junt amb una conclusió del treball realitzat.

S'espera amb tot plegat que aquest projecte pugui ser un manual de referència i ajut a aquelles persones i/o empreses que vulguin posar en practica alguna d'aquestes eines.

1.2 Objectius del Treball

L'objectiu principal d'aquest projecte és la de presentar diferents eines BI que seran analitzades en profunditat presentant l'agilitat i la facilitat d'ús i implementació que suposa cadascuna d'elles amb la finalitat de poder obtenir una eina el suficientment adaptada de tal forma que permeti la presa de decisions a les empreses en un temps real.

Les eines amb les que es centra el projecte són aquelles que tenen llicència gratuïta ¹ i també es valorarà la inserció d'eines amb llicència privada². En concret, la valoració d'ambdues llicències, es té en compte ja que venim d'un període de crisi i moltes empreses podrien no estar disposades a pagar per la utilització de solucions de intel·ligència empresarial.

Finalment, aquest treball pretén ser una guia que ajudi a les persones i/o empreses que tenen pensat implementar properament una eina BI, una guia d'ajut per tal de facilitar-los l'elecció de la més adequada a les seves funcions.

1.3 Enfocament i mètode seguit

La planificació del projecte seguirà els principis de gestió de projectes presentats al PMBOK. Per tant, seguirà les normes de direcció de projectes bàsiques que seran:

1. Iniciació del projecte
2. Planificació
3. Execució i control
4. Tancament del projecte



II.lustració 2: Cicle de vida d'un projecte segons el PMBOK

¹ És aquell programari que concedeix a tothom permís per utilitzar-lo, copiar-lo i distribuir-lo amb o sense modificacions i de forma totalment gratuïta.

² És qualsevol programari que no és lliure. El seu ús, distribució o modificació està prohibit, o requereix que es demani permís, o té tals restriccions que no es pot distribuir o modificar lliurement.

Anem a detallar cadascuna d'aquestes fases:

1. **Iniciació del projecte:** És on es comença el projecte i es on definim de forma global el mateix decidint fins on pretenem arribar, quins són els recursos disponibles, el compromís que adopta l'empresa per dur a terme el projecte, es defineix també els actors (*stakeholders*) i es on es crea l'acta de constitució.
2. **Planificació:** Sol ser una de les dues fases més llargues en el temps i pretén establir amb detall totes les actuacions necessàries planificant el temps requerit per assolir els objectius prefixats fins a l'entrega del projecte.
3. **Execució i control:** En aquesta fase es materialitzen les actuacions que s'han planificat en la etapa anterior i també sol ser una etapa bastant llarga, depèn també del nivell de correctesa de la fase anterior, si s'han planificat bé els temps, els recursos necessaris,... i es porta un control per veure si es segueixen bé les línies planificades o en cas contrari hi ha desviaments o s'han presentat riscos imprevistos. És una fase bastant crítica.
4. **Tancament del projecte:** És on s'efectua l'entrega del projecte i l'acceptació per part del client.

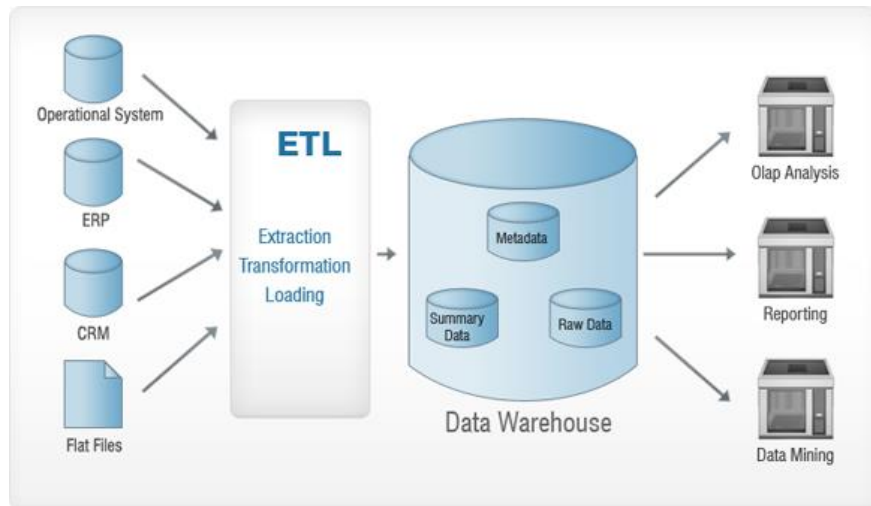
Es pot veure en més detall tot el que s'implementa en cada fase consultant el següent enllaç [Project Management best practices](#).

Donat que aquest projecte es centra en l'anàlisi d'eines BI, inicialment s'explicarà cadascun dels components que en formen part, podeu veure la il·lustració 3, i posteriorment es detallaran les diferents solucions que s'han valorat estudiant les seves funcions i característiques més generals.

Avui dia, hi ha molta competència en l'oferiment d'aquest tipus de productes, moltes d'elles són inicialment sense cost per tenir llicència lliure però ens podem trobar amb mòduls de pagament i/o suport també amb cost.

Es tenen també previstes les limitacions amb les que em puc trobar durant la recerca i anàlisi en determinats punts de cada eina, tot i així, s'intentarà donar la informació el més correcte possible igualment que les valoracions finals.

S'estudiaran les més demandades per a cada apartat de tal manera que hi hagi prou informació per donar una valoració global que ajudi a determinar quina pot ser la més adequada per a la seva implantació al negoci.



II. Il·lustració 3: Arquitectura general de solucions *Business Intelligence*

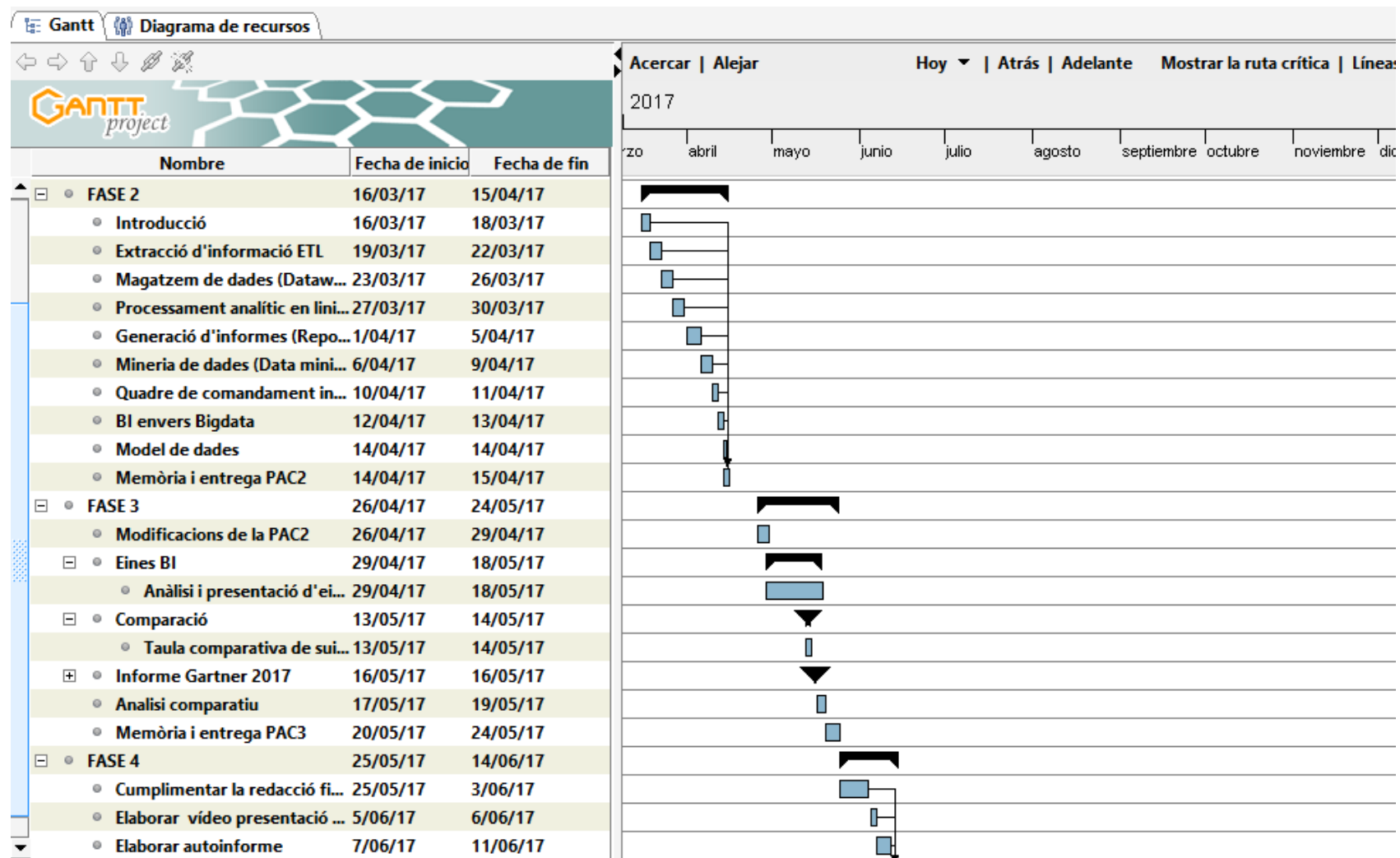
1.4 Planificació del Treball

Un cop presentada la proposta del TFG i acceptada per el tutor s'ha procedit a buscar la informació necessària per posar el projecte en marxa i fer la descomposició de tota la feina en petites fites planificades amb la eina GanttProject.

Per tant, revisant les dates d'entrega de l'aula i la feina a realitzar i que el projecte ha d'implicar 300hores, la planificació temporal queda detallada en el següent diagrama de Gantt tenint en compte una dedicació diària aproximadament de 2,5 hores per donar un seguiment correcte al TFG presentat.

No es presenten festius ni ponts al diagrama donat que pretenc donar-li un seguiment diari fins a la finalització del mateix.

Així doncs, podeu observar la planificació a la il·lustració 4.



II.lustració 4: Planificació temporal del TFG

1.5 Breu sumari de productes obtinguts

Aquest treball de fi de grau està centrat en l'anàlisi de les diferents eines existents al mercat actual que permeten donar coneixement a l'empresa.

És evident, que no es fàcil fer-ne la tria de les millors aplicacions i descartar-ne les que no siguin tant pràctiques i es per això que m'he centrat molt en l'anàlisi del 2.017 que ofereix Gartner anualment, en concret, m'he basat en el requadre que podeu trobar a la [Figura 34](#) i que detalla clarament les aplicacions més demandades en l'actualitat.

Tot i així, he intentat seleccionar una variant de cada nucli per poder-ne fer finalment una comparativa més justa que trobareu al final d'aquesta memòria.

Espero que tot aquest treball pugui ser un referent per a moltes persones que intenten decidir quina es la millor aplicació a utilitzar en les seves organitzacions.

1.6 Breu descripció dels altres capítols de la memòria

En aquest projecte s'han avaluat les diferents eines més valorades en el moment per a la gestió i l'explotació de la informació i/o dades d'una empresa.

En concret, s'ha fet una introducció als models de dades més utilitzats i llavors s'ha anat parlant de forma més detallada cadascun dels processos que formen un sistema BI com serien:

- **Processos ETL:** Descripció i fases del procés, explicant el seu funcionament, com es procedeix a la neteja de dades i com es fa l'extracció, la transformació i la càrrega de dades. S'han descrit algunes de les eines ETL més utilitzades amb una taula que compara els diferents productes.
- **Magatzems de dades:** Es comenta com es dissenya i com funciona un magatzem de dades i es comenten les bases de dades que es solen utilitzar en aquest tipus d'entorn BI.
- **Processament analític en línia:** es fa una descripció dels models amb estructures multidimensionals com serien OLAP.
- **Generació d'informes:** És un dels apartats importants donat que es qui genera els informes basant-se en les dades extretes dels processos anteriors. A més, s'expliquen les diferents eines més populars del moment i podreu trobar-hi una comparativa.

- **Mineria de dades:** És l'eina que busca patrons repetitius que ajuden a donar explicació al comportament de les dades i s'exposa les quatre etapes principals de les quals es compon un Data mining.
- **Quadre de comandament:** Són les eines que permeten visualitzar els indicadors de les empreses hi s'explica la classificació i les categories existents a partir de la seva funcionalitat.
- **Comparativa del BI vs el Big Data:** Es fa una breu comparativa amb l'actual i gran conegut sistema Big Data, predecessor dels sistemes BI però en cap cas és, almenys actualment, el seu substitut.
- **Eines BI (Suites):** S'expliquen en aquest apartat les eines BI més valorades del moment agafant com a referència les que han surtit aquest any al informe Gartner. Finalment, es pot consultar una taula comparativa dels diferents productes.

Tots aquests apartats descrits anteriorment estan perfectament alineats amb l'objectiu d'aquest projecte que pretén apropar al lector a les diferents eines parcials d'un sistema BI apropant-lo a les grans suites existents, de fàcil gestió, algunes més cares i d'altres gratuïtes però no per això menys eficients per tal d'ajudar al lector en el seu trajecte per a la implantació d'un sistema BI en les seves organitzacions.

2. Introducció al Business Intelligence

En primer lloc, situant la intel·ligència de negoci (BI) en algun punt de la història, trobem que al 1989 Howard Dresner va començar a utilitzar ja aquest terme i en va escriure un article on descrivia les característiques que ha de tenir un sistema d'aquest tipus. També podem trobar al 1958 a Luhn que també en parlava fent una clara descripció del que avui dia coneixem per BI, per tant, tot i que pensem que aquesta forma de treball és molt innovadora, es pot observar que ja fa molts anys que existeix encara que, segons l'època, es presenti en formats diferents.

Avui dia, la intel·ligència de negoci en una empresa, actua com un factor estratègic generant un potencial d'avantatge competitiu, que en definitiva podríem dir que el que fa es proporcionar informació privilegiada per poder donar resposta als problemes del negoci com per exemple voler tenir un millor control financer, optimització de costos, entrada a nous mercats, anàlisis de perfils de clients, ...

La capacitat que té un negoci per prendre decisions d'una forma ràpida i eficient s'ha convertit en una de les claus d'èxit per les empreses.

Per tant, des d'un punt de vista molt més pragmàtic i fent una associació directa amb les tecnologies de la informació, es pot definir el BI com un conjunt de metodologies, aplicacions i tecnologies que permeten reunir, depurar i transformar les dades dels sistemes transaccionals de l'empresa en informació desestructurada, interna i externa de l'empresa, en informació estructurada per tal de fer-ne una explotació de totes aquestes dades a través d'informes (reports), anàlisis OLTP/OLAP, avisos, entre altres o per tal de fer-ne una anàlisis per convertir-la en coneixements donant així un suport a l'empresa en la presa de decisions.

Aquesta intel·ligència de negoci actua com un factor estratègic per a una empresa generant axí un avantatge competitiu molt important en la competència empresarial d'avui dia i que ofereix a l'empresa una informació privilegiada per respondre a les possibilitats de negoci com per exemple, entrada a nous mercats, optimització de costos, planificació de la producció amb reducció de costos, anàlisis del tipus de clients amb possibilitat d'oferir ofertes 'personalitzades', etc...

Els principals productes BI que existeixen avui dia són:

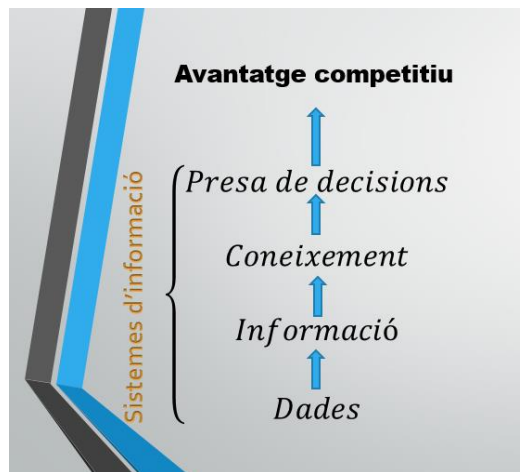
- Quadre de comandament integral (CMI)
- Sistemes de suport a la decisió (DSS)
- Sistemes de informació executiva (EIS)

En canvi, els principals components d'origen de dades que existeix actualment són:

- Datamart
- Datawarehouse

En resum, una solució BI integral permet a l'empresa:

- Observar què està passant.
- Entendre perquè està passant.
- Predir el què podrà passar i així donar temps a reaccionar.
- Col.laborar. Decidir que ha de fer l'equip.
- Optar per un camí.



Il.lustració 5: Intel·ligència de negocis

3. Models de dades

El modelat de les dades forma part de la informació que roman a l'empresa emmagatzemant en una base de dades relacional la informació digitalitzada i que facilita el treball i ajuda a mantenir el control de les dades.

És important disposar d'un modelat adient als sistemes utilitzats per l'entitat i per facilitar-ne el seu ús tot i que avui dia hi ha una gran diversitat de modelats, alguns d'ells aprofiten les noves oportunitats que ofereix Internet i l'avantatge dels sistemes distribuïts o Clouds i d'altres treballen més en xarxes de la pròpia empresa.

Partint de la base de dades creada a l'empresa, ens podem trobar amb diferents tipus de modelats, a continuació es descriuen aquells més destacats tenint en compte que darrerament les noves tecnologies que utilitzen internet van canviant les tendències actuals.

A continuació veurem els models de dades més utilitzats per el Datawarehouse.

3.1. Model relacional

Actualment, és el sistema més utilitzat per modelitzar dades tot i que els seus inicis daten dels anys vuitanta on gran quantitat de BD aplicaven aquest model.

Consisteix en una representació de l'estructura de la base de dades en representacions tabulars, conegudes com a taules, que representen entitats de tipus conceptual formades per files i columnes. Les columnes formen els camps, característiques que volem guardar de les entitats i les files són els registres, les línies on s'emmagatzema la informació dels diferents camps relacionats en aquesta línia d'informació.

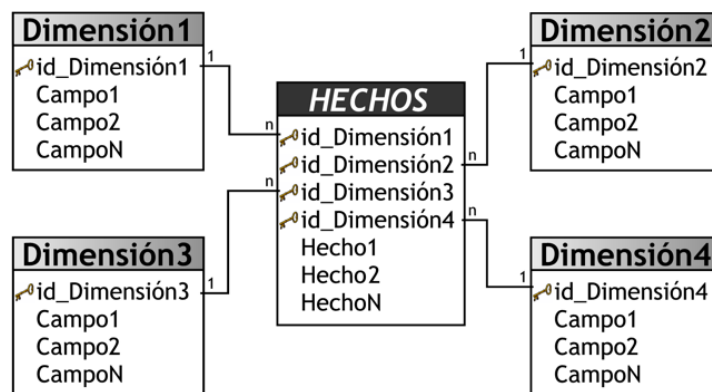
Les diferents taules poden tenir establertes unes series de relacions on s'utilitzen claus primàries (Primary Key, servei per evitar la duplicitat de registres) i claus externes (Foreign Key, identifica claus primàries d'altres taules, relacionant així, dades entre duos o més taules).

En els models de dades relacionals, no té importància la ubicació física de les dades i per això possibilita la independència física de les dades, però, és convenient, estructurar les taules d'una forma correcta i ben estructurada segons els requisits de l'empresa ja que així serà més fàcil la gestió i manipulació de les dades.

3.1.1. Esquema en estrella

Aquest és el model més simple en quant a estructura. La seva composició està formada per una taula central de ‘fets’³ i varies ‘dimensions’⁴. La característica més important d’aquest model es que només existeix una taula de dimensions per a cada dimensió, o sigui, que la única taula que té relació amb una altra és la de ‘fets’, per tant, tota la informació relacionada amb una dimensió ha d’estar en una sola taula.

Si us fixeu en la següent figura es pot observar que la taula de ‘Hechos’ esta formada per claus foranes (FK) i a partir d’aquestes es poden fer diferents interrogacions a la base de dades mesurant la taula ‘Hechos’ en quatre dimensions diferents: *dimensió 1*, *dimensió 2*, *dimensió 3*, *dimensió 4*.



Il.lustració 6: Model en estrella

3.1.2. Esquema en ‘copo de nieve’

Aquest tipus d’esquema és una extensió del model en estrella i en aquest cas està format per una taula de ‘fets’ central i un conjunt de taules de dimensions.

Tal i com es pot observar en la figura 7, en aquest cas la taula de ‘fets’ no es trobarà directament relacionada amb totes les taules de dimensions sinó que es pot donar el cas de relacions indirectes a través d’altres taules com seria el cas de la taula ‘Dimensió3’ i ‘Dimensió3a’.

Aquest model de dades pot resultar més complicat que l’esquema en estrella però té l’avantatge que ens pot aportar millor la informació i ens ajuda a augmentar l’eficiència i l’espai utilitzat a més de reduir clarament la redundància de les dades entre les diferents taules.

³ Fets: Col·lecció de peces de dades i dades de context. Cada fet representa una part del negoci, una transacció o un event.

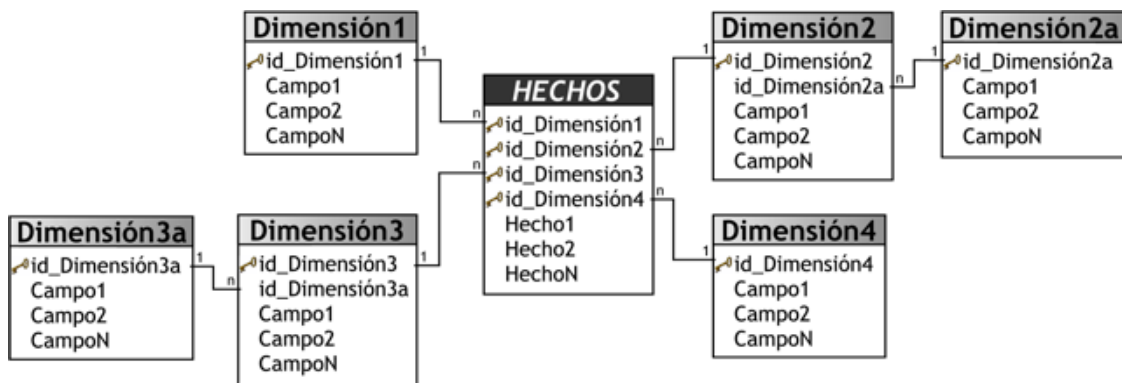
⁴ Dimensions: És una col·lecció de membres, unitats o individus del mateix tipus. Conté dades qualitatives.

Un dels motius de fer servir aquest esquema es que és molt flexible i es pot implementar després d'haver desenvolupat un esquema en estrella.

Per tant, podríem definir les següents característiques d'aquest model:

- Estructura de disseny mes complexa.
- Utilitza molt millor l'espai.
- Les taules de dimensions estan normalitzades, per tant, es requereix menys esforç de disseny.

En conseqüència, podem dir que tot i les avantatges del model, s'ha de tenir especial cura alhora de definir les diferents jerarquies, ja que, es podria donar el cas que les consultes tardin molta més estona en retornar els resultats degut a que s'han de fer unions de les diferents taules.



Il·lustració 7: Model 'Copo de nieve'

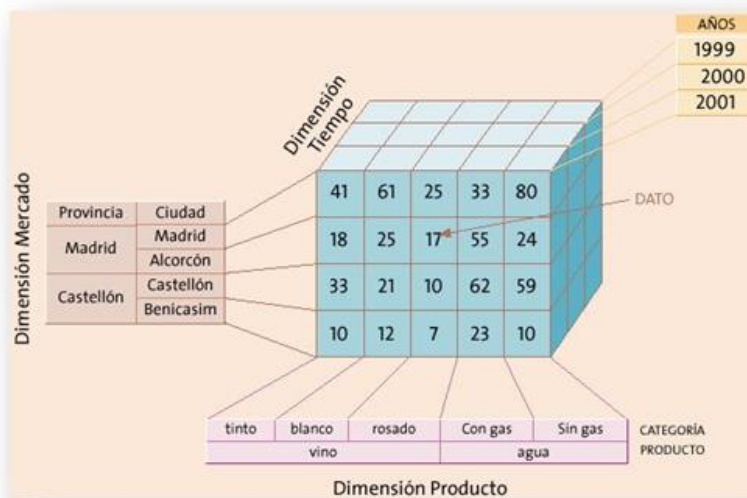
3.1.3. Model multidimensional

Aquest model no es gaire diferent del model de dades relacional, és a dir, les taules poden ser les mateixes però la diferència es troba en els camps o atributs de la taula ja que aquests poden representar dimensions de la taula, o bé poden fer representació de mètriques.

Les bases de dades multidimensionals són bases de dades dissenyades per a optimitzar el processament analític en línia, conegut com OLAP⁵. La característica més important és la forma en què estructura les dades en els anomenats cubs OLAP. Podeu observar un exemple a la il·lustració 8 on es veuen les diferents dimensions aportades a l'exemple i com es relaciona la informació entre elles.

Un cub OLAP és una estructura de dades que permet accedir a la informació d'una forma molt ràpida i organitza aquesta en diverses perspectives o dimensions, per tant, es veu clarament que per el tractament i/o consultes a grans dimensions de molts registres, aquest sistema de bases de dades és molt més àgil que el model relacional.

⁵ OLAP: On-Line Analytical Processing. Processament analític en línia.



II.lustració 8: Model de dades multidimensional

4. Processos ETL^[1]

En aquest apartat em centraré sobretot en les diferents solucions existents per el emmagatzematge de les dades i el procés ETL.

Els processos ETL provenen de l'anglès i les seves sigles signifiquen: Extract-Transform-Load, el que ho podríem traduir com a Extreure-Transformar-Carregar referit a les dades d'una empresa.

ETL organitza el flux de les dades entre diferents sistemes i aquesta fase de carregar dades i importar es sol fer amb una de les eines ETL en el llenguatge dedicat a les bases de dades com podria ser PL/SQL⁶ d'Oracle. En el procés, s'organitzen el flux de les dades entre els diferents sistemes de la organització i a més, aporta totes les eines i mètodes necessaris per tal de poder moure dades des de les diferents fonts de magatzem de dades de què disposi l'organització.

El magatzem de dades es sol implementar en una arquitectura de base de dades, habitualment ens trobem amb Oracle o SQL Server o amb productes dedicats com podria ser Teradata⁷ entre altres.

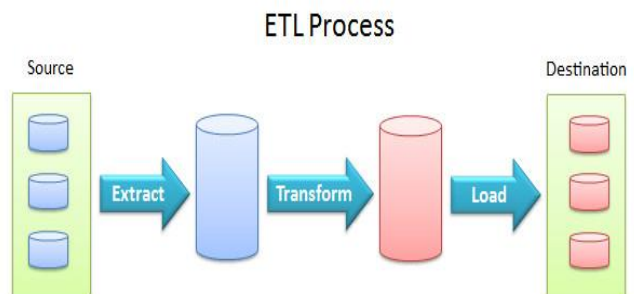
Aquestes dades caldrà tractar-les i per tant es possible que se les hagi de reformatar, polir-les, netejar-les i carregar-les en una altra base de dades, data mart o magatzem de dades abans d'analitzar-les.

ETL forma part de la Intel·ligència de negoci i també se'l coneix com a Gestor de les dades (Data Management).

4.1. Fases d'un procés ETL

Les diferents fases d'un procés ETL són:

- **Extracció:** són les dades des d'un o varis sistemes de fonts.
- **Transformació:** És la possibilitat de reformatar, polir i netejar les dades quan sigui necessari.
- **Càrrega:** la càrrega de les dades en un altra lloc o base de dades, podria ser un *data mart* o *data warehouse* amb l'objectiu de ser analitzats per donar coneixement i/o informació.



II.lustració 9: Arquitectura Data warehouse

⁶ PL/SQL: Procedural Language/Structured Query Language

⁷ Teradata: Empresa Californiana especialitzada en eines data warehousing i eines analítiques.

4.2. Neteja de les dades

Aquesta es podria entendre com una acció a fer durant el procés de transformació de les dades però en l'actualitat es sol considerar aquest procés com una fase separada del procés de ETL però molt necessària.

Per guanyar temps i efectivitat es convenient unificar criteris entre les dades per exemple: fent ús de l'estàndard ISO a les dates els hi donaríem el format *'dd/mm/yyyy'* enlloc de *'dd/mm/yy'* a tots els registres abans de començar el procés d'ETL.

Aquest procés ens permetrà tenir totes les dades de forma consolidada però també s'haurà de comprovar que les dades introduïdes siguin correctes i tinguin una única visió per a tots els usuaris. D'aquesta manera aconseguirem que els circuits de treball i anàlisis d'aquestes dades siguin realment òptims i efectives.

4.3. ETL un sistema efectiu però amb reptes

Ha quedat clara l'eficàcia i el benefici que aporta per a una organització dur a terme processos d'aquest tipus, permet la integració de grans bases de dades aportant així una visió única i global que permet analitzar i prendre decisions adequades.

En canvi, suposa un repte la seva implantació ja que ha de permetre la integració de tots els sistemes *legacy* o *heretats*, significa que alguns d'aquests sistemes poden ser tancats, no permetre canvis i tenir un accés complicat (utilització de *drivers* especials), en canvi, ens podem trobar altres sistemes més moderns basats en Windows o Linux que són oberts i interconnectats. Donat que l'accés a tots aquests sistemes s'ha de produir no només en mode lectura sinó també en mode escriptura, ens podem trobar amb problemes importants a solucionar.

Finalment, podríem procedir a fer la càrrega de dades dins el magatzem de dades i això ho podem fer o bé amb processos per lots programats i planificats o fila a fila, més o menys en temps real.

4.4. Fase extracció.

Per realitzar correctament la fase d'extracció seria bo seguir les següents passes:

1. Extreure les dades del sistema o sistemes d'origen.
2. Analitzar les dades extretes i fer-ne una revisió de les mateixes.
3. Interpretar aquesta revisió per verificar que les dades extretes compleixen la pauta o estructura que s'havia planificat. En cas contrari, les dades haurien de ser rebutjades.
4. Convertir les dades en un format preparat per iniciar el procés de transformació.

A més, és convenient tenir en compte amb vital importància que durant aquest procés l'impacte que pugui patir el sistema origen sigui sempre molt reduït. Podria donar-se el cas que si les dades a extreure siguin moltes, llavors, el sistema origen es podria alentir i inclús col·lapsar entorpint així la tasca diària.

4.5. Fase de transformació

La fase de transformació d'un procés d'ETL aplica una sèrie de regles de negoci o funcions sobre les dades que s'han extret per a convertir-los en dades que seran carregades.

Aquestes dades hauran de seguir un procés de 'neteja' i alguns dels procediments que es segueixen per dur a terme aquesta tasca són:

1. Parsing: és el procés d'analitzar una cadena de caràcters o símbols per tal de normalitzar el seu format.
2. Correcció d'errors sintàctics i comprovació de la veracitat de les dades.
3. Transformació de les dades utilitzant formats estàndards de la ISO que faciliten el processat de les dades.
4. Buscar relació entre les dades per simplificar-les.

Aquest procés és el que s'haurà de seguir cada vegada que vulguem incorporar dades al magatzem de dades (Data Warehouse).

4.6. Fase de càrrega

Aquesta és una fase aparentment senzilla però alhora pot ser molt crítica donat que si tot el procés anterior no s'ha realitzat acuradament i/o durant el traspàs de les dades hi ha un error de procés, es podria donar el cas que les dades finals no siguin les desitjades i per tant els anàlisis posteriors no serien correctes.

Depenent dels requeriments de la organització, aquest procés pot avarcar una àmplia varietat d'accions diferents a fer.

Existeixen dues formes bàsiques de fer el procés de càrrega:

1. **Acumulació simple:** Consisteix en realitzar un resum de totes les transaccions compreses dins el període seleccionat i transportar el resultat com una única transacció cap al Data Warehouse, emmagatzemant un valor calculat que provindrà d'un càlcul sumatori o una mitjana. Aquesta seria la forma més senzilla de dur a terme la càrrega.
2. **Rolling:** Recomanable quan es vol considerar diferents nivells de granuralitat. En aquest cas, s'emmagatzema informació resumida a diferents nivells, corresponent a diferents agrupacions de la unitat de temps o diferents nivells jeràrquics, per exemple: TotalSetmanal, TotalCaramelsA, ...)

4.7. Eines ETL

Arribats a aquest punt veiem que els processos ETL solen ser complexes per la quantitat de dades i els diferents sistemes amb què han de treballar, així doncs, a vegades no es fàcil escollir una bona eina que ajudi a fer tot aquest procés d'una forma fàcil, àgil i eficient.

En la següent taula es mostraran varies de les eines Open Source més populars i eficients que podem trobar avui dia amb una breu descripció del seu funcionament i URL de localització.

Eina	Descripció	URL
Talend Open Studio	És una de les eines ETL més potents de integració de dades. És gratuïta i s'ha publicat com a Open Source i disposa d'una gran quantitat de connectors que es poden consultar a la web de Talent. És capaç de carregar arxius de dades de diferents fonts, de fer-ne les transformacions necessàries, de barrejar les dades i inserir-les en una base de dades i al final mostrarà el resultat amb un informe del procés. És una eina molt fàcil d'aprendre a utilitzar.	Talend Open Studio https://talendforge.org/components/index.php Connectors: https://talendforge.org/components/index.php
Scriptella	És una eina llançada per Apache, que junt amb el funcionament ETL també s'utilitza en les seqüències de comandament Java d'execució. És una eina popular per la seva facilitat d'ús. Permet l'execució de guions escrits en SQL, JavaScript, JEXL, Velocity i la migració de la base de dades amb LDAP, JDBC, XML entre altres.	Scriptella http://scriptella.org/
Ketl	Basat en JAVA. El motor es basa en arquitectura oberta, basada en XML. Inclou suport per la integració d'eines de seguretat i de gestió de dades, és escalable en diferents servidors i CPU's i qualsevol volum de dades i sense programació de terceres persones.	KETL https://www.ketl.co.uk/
Data Integration – Kettle - Pentaho	Interfície intuïtiva i gràfica, d'arrastra i deixar anar. Eines d'integració de dades. No cal escriure línies de codi per fer-lo anar i disposa de plugins.	Pentaho http://www.pentaho.com/product/data-integration
JasperSoft ETL	Extreu, transforma i carrega dades de diferents fonts a un magatzem de dades o data mart per la creació d'informes i anàlisis. Facilitat d'ús i instal·lació.	JasperSoft https://www.jaspersoft.com/es/integracion-de-datos
GeoKettle	És ràpida i estable, té moltes funcions i llegeix i escriu en diferents formats de fitxers, serveis i SGBD. Extreu informació de més de 35 gestors de base de dades i té diferents formats de transformació de dades. Interfície	GeoKettle http://www.spatialytics.org/

	gràfica, permet execucions remotes, API de programació en Java entre altres. La fan servir governs, bancs, ...	
Apatar	Permet la integració de dades en multi plataforma i permet connectivitat a diferents bases de dades, aplicacions, protocols, arxius, ... Interfície d'usuari molt intuïtiva i no requereix codificació per configurar-lo.	Apatar http://www.apatar.com/
HPCC Systems	Incorpora una arquitectura de software implementada en clústers per proporcionar alt rendiment. A més, inclou configuracions de sistema per recolzar processaments de dades en lots i d'alt rendiment d'aplicacions de consulta en línia fent ús d'arxius de dades indexats.	HPCC Systems https://hpccsystems.com/

Fins aquí un recull de les eines més popular dels mercat, no ha estat fàcil perquè hi ha infinitat però més o menys totes tenen un patró comú hi es que les interfícies amb les que treballen són gràfiques i això facilita més la manipulació de les dades i/o configuració del procés a realitzar.

L'avantatge de totes elles es que són open source tot i que cal dir que algunes no tota la seva funcionalitat es gratuïta sinó que hi ha mòduls que són de pagament, llavors, s'ha de tenir en compte aquesta part a l'hora de buscar un producte adient a les necessitats de l'empresa.

Una base important es primer analitzar el tipus de dades que tenim i com les volem manipular i a partir d'aquí escollir el millor producte a utilitzar.

Per a més claredat en els avantatges que podem obtenir de cadascuna de les eines, a continuació s'adjunta una comparativa més esquemàtica de les característiques de cadascuna:

EINA ETL	Llicència	Treball amb altres fonts d'informació	Generació d'informes	Facilitat d'ús	Requereix persones expertes	Interconnexió amb diferents BDD?	Sistema operatiu que suporta
Talend Open Studio	Apache V2.0	Sí	Sí	Sí	No necessàriament	Sí	Windows /Linux/MAC
Scriptella	Apache V2.0	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC
Ketl	GPL 2.0	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC
Data Integration - Kettle - Pentaho	Apache V2.0	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC
JasperSoft ETL	Apache V2.0	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC
GeoKettle	GNU LGPL V 2.1	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC/SOLARIS
Apatar	General Public License (GPL)	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC
HPCC Systems	Apache V2.0	Sí	Sí	Sí	No	Sí	Windows /Linux/MAC

II.Iustració 10: Taula comparativa

La taula següent mostra els trets més característics de cadascuna:

	Processe informació	Interfície d'usuari	Comunitat d'usuaris	Logar-se al sistema	Costat d'error	Traballa per omplir ata	Altres productes que ofereixen	Entorn desenvolup ament
Talend Open Studio	Simple i fàcil de configurar	Molts components i requereix més detalls. Pot dificultar la feina.	Comunitat d'usuaris més reduïda i a vegades costa més trobar suport amb facilitat.	Logs diferenciats per accés a estadístics, de procés,...	S'ha d'iniciar tot el procés de nou.	Tot el codi generat es visible i reutilitzable	Big Data, MDM, Data Quality, ESB, Talend Data Preparation	JAVA
Scriptella	Molt simple i fàcil de configurar	Mode gràfic senzill d'utilitzar	Gran comunitat d'usuaris i es fàcil trobar suport online molt ràpid	Mecanisme estandard de logar-se al sistema	Es tracten via elements.	Codi generat reutilitzable	No trobats	JAVA
Kinetic etl	Simple i fàcil de configurar	Mode gràfic senzill per a usuaris sense coneixements	No molt extensa.	Mecanisme estandard de logar-se al sistema	Sense informació	Tot el codi generat es visible i reutilitzable	No trobats	JAVA
Data Integration - Kettle - Pentaho	Simple i fàcil de configurar	Fàcil de navegar i requereix poques opcions per fer-ne la integració.	Gran comunitat d'usuaris i es fàcil trobar suport online molt ràpid	Número de loggins a la DBMS limitat.	Es pot continuar a partir d'on es va generar l'error.	JavaScript no pot ser reutilitzat a través dels objectes	Pentaho Analytics Platform, Pentaho Report Designer	JAVA
JasperSoft ETL	Simple i fàcil de configurar	Molts components i requereix més detalls. Pot dificultar la feina.	Comunitat d'usuaris més reduïda i a vegades costa més trobar suport amb facilitat.	Logs diferenciats	S'ha de reiniciar tot el procés	Codi generat visible i reutilitzable	Es un subconjunt de Talend	JAVA
GeoKettle	Simple i fàcil de configurar	Mode gràfic per l'usuari i eines de línies de comandament disponibles.	Gran comunitat d'usuaris i es fàcil trobar suport online	Número de loggins a la DBMS limitat.	Es pot continuar a partir d'on es va generar l'error.	JavaScript no pot ser reutilitzat a través dels objectes	Versió habilitada per a operacions espals de Pentaho Data Integration. Cookbook, Meta-Geocoding	JAVA
Apatar	Intuitiu i fàcil de configurar en poc temps.	Sense codificació. Entorn visual de treball pensat per la petita i gran empresa.	Forum oficial a partir de la subscripció i descàrrega de l'aplicació desde la web oficial.	Mecanisme estandard de logar-se al sistema	S'ha de reiniciar tot el procés	Definits amb XML	Merge, On-Demand	JAVA
HPCC Systems	Simple i fàcil de configurar	Mode gràfic per l'usuari i eines de línies de comandament disponibles.	Forums per la versió gratuïta i suport per la versió amb llicència	Mecanisme estandard de logar-se al sistema. Possibilitat de creació de grups de treball.	Servei gràfic de gestió d'errors per veure que ha passat i a on.	Codi generat reutilitzable	No trobats	C++

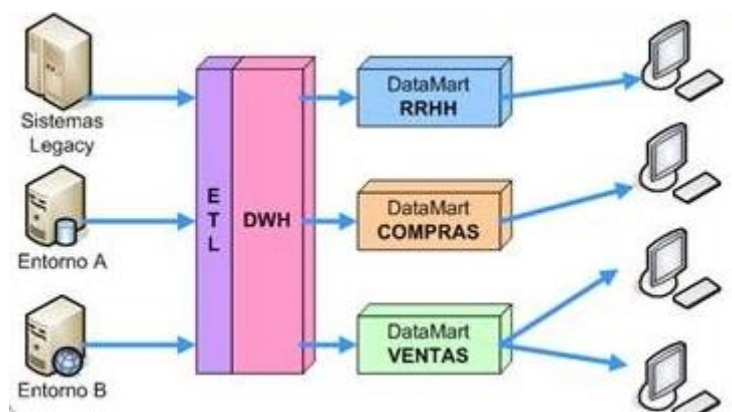
II.Iustració 11: Taula comparativa

5. Magatzem de dades

5.1. Definició

Podria definir el que entén Bill Inmon o Ralph Kimball per a magatzem de dades però em centraré en una definició més general i es que entenem que un magatzem d'aquest tipus ve donat per els seus components bàsics que són els mitjans per obtenir les dades, per extreure-les, transformar-les i fer-ne la càrrega, les tècniques per analitzar-les i generar els informes. És per això, que prèviament al tractament d'aquestes es bo conèixer amb quina base de dades, també coneguda com a Data Warehouse, es vol treballar que integri tota aquesta informació tractada, d'aquesta manera les diferents solucions BI podran treballar amb aquesta informació.

En la següent il·lustració podeu veure en quin lloc del procés BI està ubicada la base de dades (DW).



II. Il·lustració 12: Magatzem de dades

5.2. Disseny d'un magatzem de dades

Per construir un Data Warehouse es necessiten primer de tot eines que ens permetin fer la migració i la transformació de les dades cap al magatzem i una vegada haguem fet això, ens caldran mitjans per manipular grans volums de informació.

La seva estructura s'ha de dissenyar en dependència de l'estructura interna de les dades del magatzem i sobretot tenint present els tipus de consultes que es realitzaran. Llavors les dades s'han de repartir en data marts⁸.

Prèviament a la realització d'un projecte DW caldrà fer un anàlisi de la organització i saber quin és el punt de partida, quines són les característiques del negoci, l'entorn tècnic actual i necessari, quines són les expectatives dels usuaris, les etapes de desenvolupament del

⁸ Data mart: Subconjunt de dades amb el propòsit d'ajudar a un àrea específica dins del negoci per poder prendre millor les decisions.

projecte, realitzar un prototipatge per veure si s'ha entès bé el projecte i finalment es podria fer una prova per avaluar si el data warehouse funcionarà com està previst.

5.3. Funció del magatzem de dades

En el magatzem de dades hi haurà d'arribar només la informació que s'utilitzarà com un repositori de dades per posteriorment fer-ne la transformació en informació útil per l'usuari.

L'anàlisi dels processos de traspàs de la informació s'ha de fer de forma acurada i tenint la certesa que la informació que ens ha arribat és la correcta ja que el DW ha d'entregar aquestes dades a la gent indicada en el moment òptim i en el format adequat.

El magatzem de dades ha de donar resposta a les necessitats dels usuaris experts fent ús de sistemes de suport de decisions (DSS), sistemes de informació executiva (EIS) o bé eines per fer consultes i/o informes.

La construcció del DW és a partir del procés ETL explicat en l'apartat anterior on la informació procedeix de diferents fonts per ajudar a la presa de decisions i per tant es caracteritza per:

- Tenir dades orientades al negoci.
- Les dades han de romandre indexades permetent el seu anàlisi durant la seva evolució en el temps.
- La informació ha d'estar estandarditzada amb dades consistents. És important en aquests cas fer ús d'estàndards ISO.
- Les dades d'aquest magatzem no s'han de poder-se manipular per l'usuari, només tenir-ne un accés de consulta de dades per garantir-ne la seva fiabilitat.
- El DW pot arribar a una àrea determinada, un departament o tot el negoci segons el que es necessiti a nivell d'empresa.

Doncs arribats a aquest punt, una base de dades d'aquestes característiques ha de ser robusta, fiable i a nivell de sistemes mantenir sempre les seves actualitzacions tant de software com de hardware per donar garanties de fiabilitat i rapidesa.

5.4 Bases de dades utilitzades en entorns BI

Arribats a aquest punt, no es fàcil saber quina és la millor base de dades a utilitzar en el nostre negoci. La seva elecció dependrà de la gestió que en vulguem fer de la informació que hi guardi, del cost econòmic que puguem assumir, les possibilitats d'integració que aquesta ens pugui oferir,...

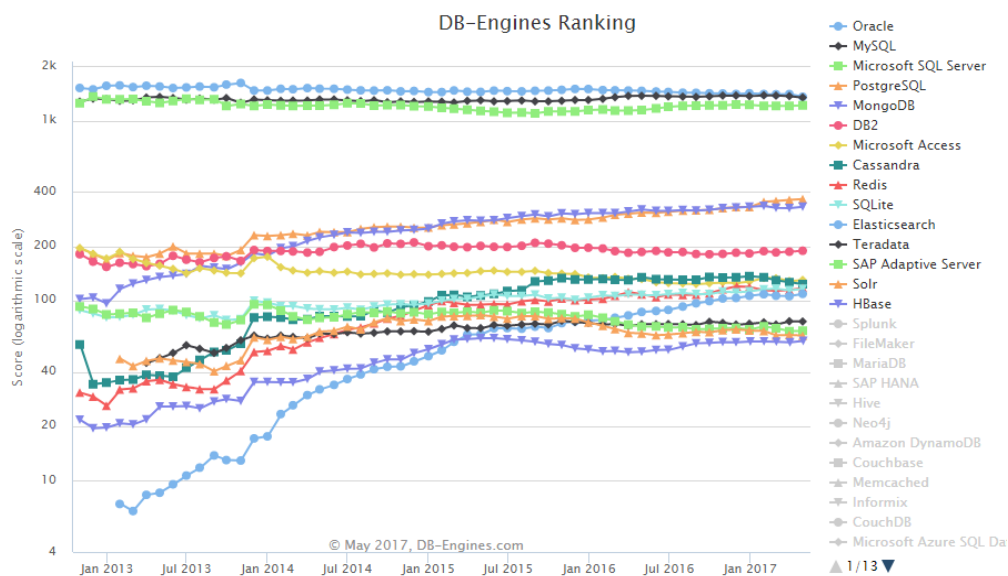
D'entrada anem a observar a la taula que hi ha a continuació, quins són els rànquings actuals segons els estudis realitzats per DB-Engines que

podeu trobar en la seva pàgina web <https://db-engines.com/en/ranking>, l'estudi és del maig del 2017 i en la mateixa web podeu trobar un enllaç amb els criteris que han seguit i l'evolució de l'ús de les diferents bases de dades en els darrers anys.

327 systems in ranking, May 2017

Rank			DBMS	Database Model	Score		
May 2017	Apr 2017	May 2016			May 2017	Apr 2017	May 2016
1.	1.	1.	Oracle +	Relational DBMS	1354.31	-47.68	-107.71
2.	2.	2.	MySQL +	Relational DBMS	1340.03	-24.59	-31.80
3.	3.	3.	Microsoft SQL Server +	Relational DBMS	1213.80	+9.03	+70.98
4.	4.	↑ 5.	PostgreSQL +	Relational DBMS	365.91	+4.14	+58.30
5.	5.	↓ 4.	MongoDB +	Document store	331.58	+6.16	+11.36
6.	6.	6.	DB2 +	Relational DBMS	188.84	+2.18	+2.88
7.	7.	↑ 8.	Microsoft Access	Relational DBMS	129.87	+1.69	-1.70
8.	8.	↓ 7.	Cassandra +	Wide column store	123.11	-3.07	-11.39
9.	9.	9.	Redis +	Key-value store	117.45	+3.09	+9.21
10.	10.	10.	SQLite	Relational DBMS	116.07	+2.27	+8.81
11.	11.	11.	Elasticsearch +	Search engine	108.82	+3.15	+22.51
12.	12.	12.	Teradata	Relational DBMS	76.32	-0.23	+2.58
13.	13.	13.	SAP Adaptive Server	Relational DBMS	67.75	+0.29	-3.73

II. Il·lustració 13: Rànquing bases de dades segons estudi de DB-Engine



II. Il·lustració 14: Evolució de l'ús de les bases de dades segons DB-Engine

Com podeu observar una de les més valorades és Oracle i també ho és en el BI, en concret disposen de l'eina Oracle BI 12c que és una solució integral que encara que té un cost important, la seva funcionalitat ajuda a l'empresari i en el seu negoci podent així augmentar el retorn de la inversió per tota la organització.

De tota manera, per les empreses més petites que els sigui més difícil fer una inversió d'aquest nivell pot optar per les bases de dades Open Source també amb gran potencial de gestió com podria ser MySql.

A continuació es mostra una taula amb diferents bases de dades suportades per sistemes BI amb algunes de les seves característiques i amb ordre de popularitat:

DBMS per BI	Llicència	S.O. Suportats	Interfície	Llenguatges suportats
Oracle	Propietària	Windows, Linux, Solaris, HP-UX, OS X, z/OS, AIX	GUI, SQL	C, C#, C++, Java, Ruby, Objective C
MYSQL	Codi Lliure	Windows, Linux, OS X, FreeBSD, Solaris	SQL	C, C#, C++, Java, D, Ruby, Objective C
M. SQL Server	Propietària	Windows	SQL Server	Java, Ruby, Python, VB, .NET, PHP, PL/PgSQL, C, C++, JAVA PL/Java web, Python, Ruby, APL2, Assembler, C, C++ ;C#, COBOL, Fortran, JAVA, Perl, PHP, Python, Ruby, SQL, VB.
PostgreSQL	Codi Lliure	UNIX/ Linux, Windows, OS X	GUI, SQL	PgSQL/, C, C++, Java PL, Java web, Perl, pI PHP, Python, Ruby, Sh, Tcl, Scheme, PL/R
IBM DB2	Propietària	Linux, UNIX, Windows	GUI, SQL	
Ingres	PostgreSQL	Linux, Windows	GUI, SQL	

II. Il·lustració 15: Bases de dades per a BI

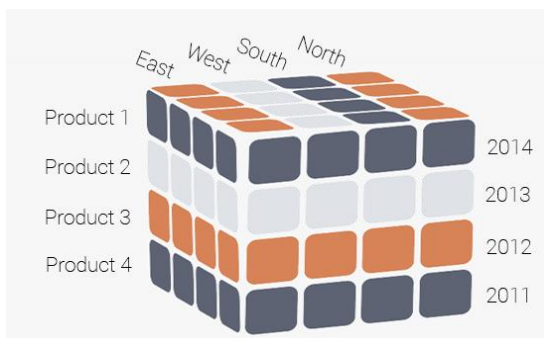
6. Processament analític en línia

El processament analític en línia se'l coneix també com a OLAP (On-line Analytical Processing). És una base de dades de les varies que es poden trobar al mercat que faciliten les consultes de la intel·ligència empresarial.

OLAP és una tecnologia de base de dades perfeccionada per fer consultes i informes enlloc del clàssic processament de transaccions tot i que el seu origen varen ser les bases de dades de processament en línia.

OLAP són models complexes amb estructures multidimensionals, tal com podeu veure en la il·lustració 11 on s'intenta donar respostes amb l'ús de grans quantitats de dades. Les dades OLAP es deriven de dades històriques i s'han agregat a estructures que permeten anàlisis molt més complexes. La organització de la informació és fa en cubs enlloc de les clàssiques taules això permet que un informe o gràfic mostri resum de dades d'alt nivell.

Un exemple pràctic del seu ús seria la vinculació de OLAP amb Microsoft Excel. El primer seria el servidor d'informació per exemple el total de vendes d'un país i el segon seria el que realitzaria els càlculs bàsics de sumes, mitjanes, ... sobre els valors ja resumits que li provenen de OLAP. Això permet treballar amb quantitats molt més grans d'origen de dades que no pas si estiguessin en una base de dades tradicional on Excel hauria de recuperar tots els registres i després fer-ne els càlculs.



Il·lustració 16: Cub OLAP

Amb OLAP ens podem trobar diferents formes de manipulació de dades que venen descrites a continuació:

- **Slicing:** Treure un subconjunt del cub i fer-lo servir per crear-ne un de nou amb una dimensió menor. Això s'utilitza per aïllar només els criteris necessaris per fer una consulta determinada.
- **Dicing:** Produir un cub més petit tirant de valors específics de múltiples dimensions. Es podria donar el cas, per exemple, de voler només dades sobre categories específiques de productes.

- **Drilling up/down:** Moure's entre els nivells de dades, o sigui, anar des dels nivells amb més detall als conjunts de dades més resumits. Per exemple, obtenir les vendes totals o el detall de cada producte.
- **Rolling up:** Obtenir un resum de les dades mitjançant la combinació d'atributs basats en una jerarquia.

Ens podem trobar diferents estructures OLAP com podem veure a continuació:

- ROLAP: Processament Analític en Línia Relacional.
- MOLAP: Processament Analític Multidimensional en Línia
- HOLAP: Processament Analític en Línia Híbrid

7. Generació d'informes

La generació d'informes es basa en mostrar informació en un report a partir de les dades obtingudes des de diferents fonts i la seva presentació dependrà del format que l'usuari li hagi volgut donar, ja sigui en format de números, gràfics,...

D'altra banda, d'aquests informes generats, usualment es procedeix a fer un anàlisi de les dades sol·licitades, facilitant als usuaris finals uns resums visuals o numèrics que els permetran prendre decisions empresarials a partir d'elles.

Aquests informes poden ser gestionats tant per professionals, desenvolupadors o usuaris finals. La seva creació sol ser bastant simple sense necessitats de personal especialitzat.

Cal diferenciar aquest tipus de components BI dels Dashboards i els Scorecards, ja que mitjançant els informes, es pot presentar la informació completa d'un negoci o d'una part d'aquest, en canvi, amb els Dashboards (quadre de comandament integral) i els Scorecards, el que s'intenta presentar és la informació en un format molt més reduït perquè amb un sol cop de vista s'entengui la informació que en ell es mostra.

Algunes de les eines de generació d'informes més destacades són les següents:

- **BIRT:** Consta de varis components, els principals inclouen un dissenyador de informes, un motor gràfic de dissenyador gràfic i de visualització.

Com funciona

És un generador d'informes basat en Eclipse i té dos components principals: l'editor d'informes i el generador d'informes (BirtUM).

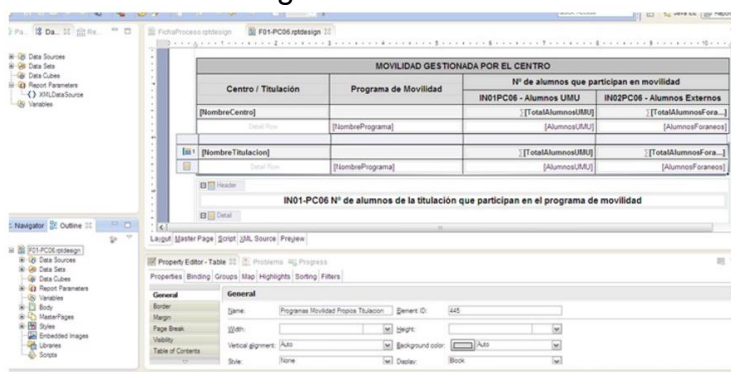
Pretén abastar el major rang de components disponibles a l'hora de realitzar un informe.

Està molt centrat en permetre dissenyar fàcilment i d'una forma molt visual, informes de forma gràfica per tal de descarregar als desenvolupadors del treball de fer plantilles d'informes demanades per cada client.

L'accés a les dades es pot fer directament sobre la BBDD, a través de csv o XML, via WebServices entre d'altres.

El filtratge de les dades és molt senzill de realitzar i ens permet parametritzar les dades d'entrada permetent configurar aspectes generals del propi informe, definir el DataSource, o sigui, l'origen

de les dades. Aquests canvis són recollits pel motor d'informes i es processen abans de la generació del document.



II. Il·lustració 17: Parametrització d'un informe en BIRT

Es permet la configuració d'escripts en JAVA per modificar el comportament o la vista final de l'informe.

Així doncs, amb les diferents opcions que tenim de personalitzar el informes permeten a l'usuari donar la forma desitjada fent ús d'una interfície fàcil i intuïtiva.

Finalment, cal esmentar que la generació d'informes XML amb BirtUM, pot tornar dos possibles resultats, un en format PDF i un altra en format XLS(multi fulla)

Birt està escrit en Java i està disponible sota Llicència Pública Eclipse. Funciona amb Windows, Linux i Mac.

- **JasperPort:** És una de les eines més populars. S'utilitza en cents de mils d'entorns de producció i compta amb una comunitat d'usuaris molt amplia. Consta de varis components incloent la biblioteca JasperReport, JasperReport d'estudi i JasperReport Servidor.

JasperReport fa servir una llibreria Java per el desenvolupament d'informes i per el disseny visual dels informes fa servir l'eina iReport.

Com funciona

JasperPort:

Permet la utilització de diferents orígens de dades: JDBC, TableModels, JavaBeans, Hibernate i CSV.

Genera informes en format PDF, HTML, XLS, CSV i XML.

Per utilitzar-lo en l'entorn Eclipse, cal incloure-hi la pròpia llibreria *jasperreports*.

La comunicació entre les iReport i JasperReport es duu a terme amb un conjunt de paràmetres definits en un objecte HashMap que consta de quatre passes, la creació dels objectes, la definició dels paràmetres, el pas de paràmetres a l'informe i finalment es podrà executar la visualització de l'informe.

iReport:

És l'aplicació que permet generar informes de JasperReports i està implementat 100% en Java i té un editor WYSIWYG(What you see is wath you get) i a més suporta totes les bases de dades accessibles a través de JDBC.

La pantalla de configuració de iReports és molt simple, té quatre carpetes tal i com es pot veure en la imatge:



II.lustració 18: Configuració de iReports

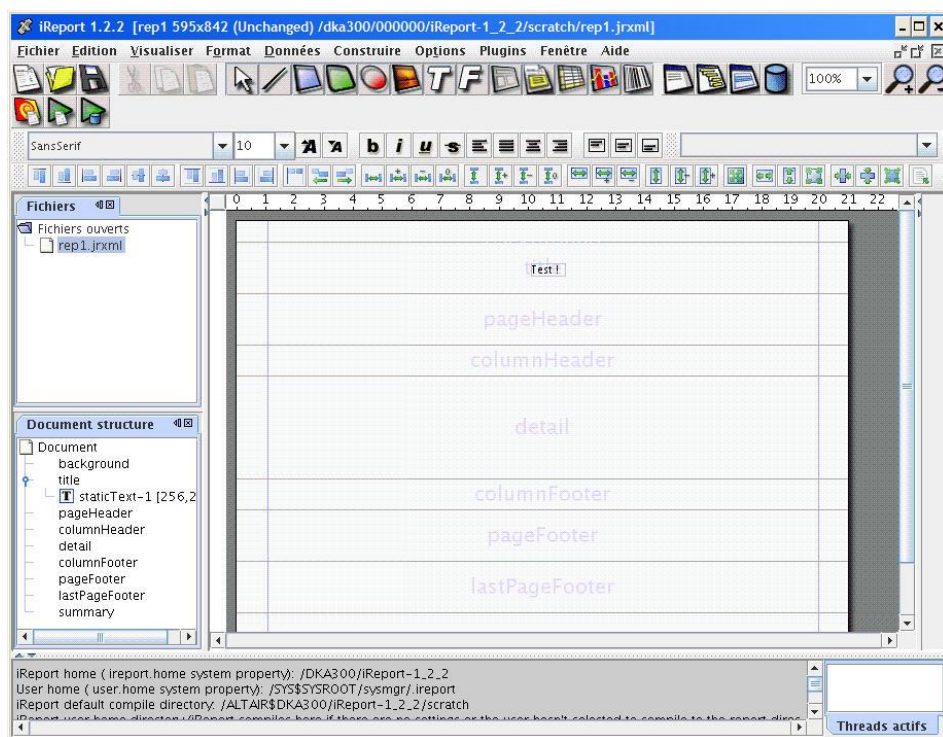
1. A la llengüeta *general* és on trobem les propietats de l'entorn, indicarem l'idioma a utilitzar, les opcions per defecte entre altres.
2. A la carpeta *compilador* és on es troba el compilador d'informes i on s'emmagatzemen els informes generats, ...
3. Tenim les opcions de Backup a la carpeta *respaldo*.
4. Definim els *programes externs* amb els que volem visualitzar els informes.

La senzillesa de creació d'informes fa que hi hagi un assistent que permet cinc passes per a la seva configuració:

- a. Selecció de la connexió i definició de la consulta SQL
- b. Selecció dels camps.
- c. Indicar si existeix alguna agrupació per algun camp.
- d. Definir l'aparença (Layout)
- e. Finalitzar assistent.

També es permesa la definició de informes personalitzats des de un entorn gràfic, en aquest cas es requereix una mica més de coneixement.

A continuació podem veure l'aspecte de l'aplicació iReports i les parts de les quals està format un informe.



II.lustració 19: Entorn iReports

Està escrit en Java i s'executa en Windows, Linux i Mac. Està disponible sota Llicència pública.

- **Pentaho Report Designer:** És una suite d'intel·ligència de negoci molt completa pensat tant per la petita, mitjana o gran empresa. Té una gran varietat de funcions apunt per fer servir a les organitzacions. A més, Pentaho Reporting és un motor d'informes integrable de pes lleuger per a executar informes i accedir a totes les fonts de dades disponibles. Es pot integrar a les aplicacions de l'empresa d'una forma àgil i senzilla i la seva llicència de codi lliure fa que aquesta sigui una gran aplicació a tenir en compte.

Com funciona

Disposem d'un assistent de creació d'informes que posteriorment i amb l'experiència obtinguda podrem crear els nostres informes sense aquesta eina.

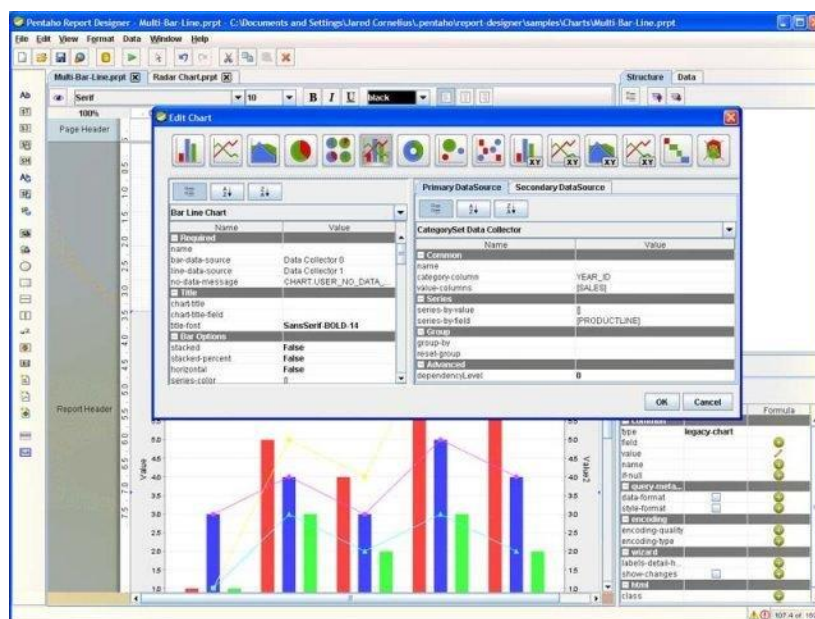
Inicialment seleccionem els camps que s'utilitzaran en el informe i hi escollim també el format i l'estil amb què el volem mostrar, i seguint la resta de passes de l'assistent crearem una plantilla que podrem modificar segons les nostres preferències.

El pas següent, seria afegir un paràmetre per enllaçar-lo amb el fitxer XML on inclourem la consulta per seleccionar els valors del paràmetre i finalment enllaçarem aquest amb l'informe.

Abans de donar per finalitzat l'informe podem previsualitzar-lo per confirmar que l'estil i les dades mostrades són les desitjades.

El resultat final el podem emmagatzemar en diferents formats com PDF, HTML, XLS, RTF i CSV.

L'entorn de l'aplicació té un format gràfic, senzill i bastant intuïtiu com el que podeu visualitzar a continuació.



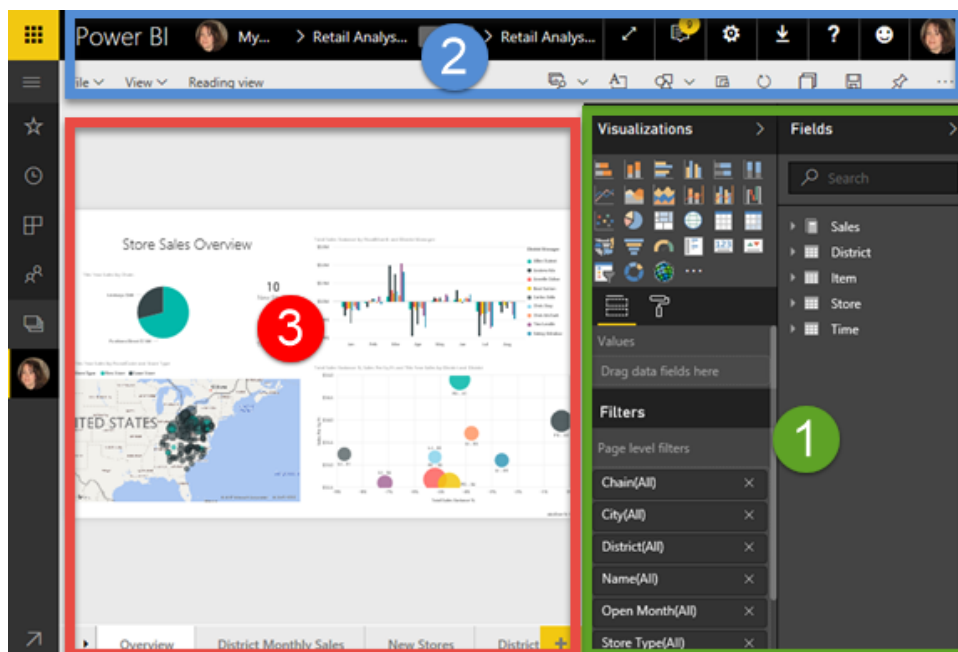
II. Il·lustració 20: Aplicació Pentaho Report

L'eina s'executa en Java Enterprise Edition i es pot fer servir en Windows, Linux, Mac. Té Llicència GPL.

- **Microsoft Power BI reporting:** És una eina dins del seu paquet integrat que permet la creació de reports on es podrà visualitzar i analitzar la informació mostrada a partir d'un anàlisi ràpid i senzill.

Com funciona

Per a la creació d'un informe s'ha de tenir els permisos de propietari i podem visualitzar l'editor d'informes que està format per les tres seccions que podeu veure a la imatge inferior:



II. Il·lustració 21: Microsoft Power BI Reports

En les diferents seccions hi trobem:

- 1.- Selecció dels camps que formaran part de l'informe, escollirem el tipus de visualització, colors, formateig, tipus i es definiran els diferents filtres que es facin servir.
- 2.- És la barra de navegació superior.
- 3.- Llenç on definirem la visualització del nostre informe. Les pestanyes que es visualitzen a la part inferior representa una pàgina a l'informe. S'ha de seleccionar una d'aquestes pestanyes per obrir aquella pàgina.

Per a la creació de l'informe, s'haurà d'importar la informació requerida des d'una de base de dades i llavors es seleccionen els camps interessats i en farem la importació. Tot seguit, visualitzem les dades a veure si són les correctes i a partir d'aquí podrem afegir al nostre informe gràfics, camps de dades i les diferents característiques que li vulguem donar al nostre informe final.

Aquesta eina permet la creació de codi QR en format JPG per a l'enviament d'informes per email o qualsevol altra mitjà, el que fa que sigui molt pràctic a l'hora de distribuir-lo.

El resultat final el podem emmagatzemar en diferents formats com PDF, XLS o XLSM, PBIX i CSV.

L'eina forma part del paquet integrat Microsoft Power BI i es pot fer servir en Windows, Linux, Mac. Power Bi Desktop és gratuïta i la resta de versions tenen una Demo de 60 dies i llavors un cost mensual no massa elevat.

Resum gràfic de les diferents aplicacions:

Informes	Llicència	Sistemes o paratius	Formats de puja s'entenció	Paquet BI	Eclipse Plug-in	NetBeans Plug-in	Java Client	Compilació de l'informe
BIRT	GPL	Windows, Linux, OS X	PDF, HTML, XLS, CSV, XML	Integració amb Pentaho	✓	✗	✓	Requerit
JasperReport	GPL	Windows, Linux, OS X	PDF, HTML, XLS, CSV, XML	JasperSoft	✓	✗	✓	No requerit
Pentaho Report Designer	GPL	Windows, Linux, OS X	PDF, HTML, XLS, CSV, XML	Pentaho	✗	✗	✓	No requerit
Microsoft Power BI Report	Comercial i Power BI Desktop és gratuïta	Windows, Linux, OS X	PDF, XLS o XLSM, PBIX, CSV	Microsoft Power BI	✗	✗	✓	No requerit

II.lustració 22: Visió de les característiques de les aplicacions per a Reports

Alguns punts forts i febles de les aplicacions els podeu consultar a continuació:

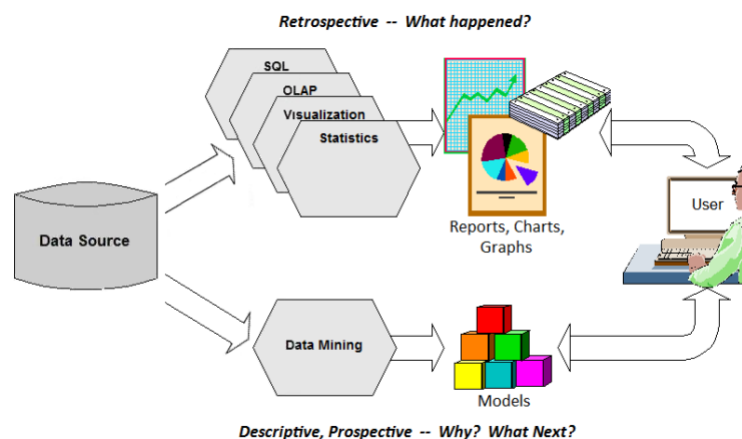
Informes	Components de disseny del report	Data Sources	Parametrització dels reports	Reutilització de codi	Integració amb altres paquets
BIRT	Molt complet, permet edició de codi de barres, creació de notes, taules, sub-reports, taules creuades,....	Permet varis data sources i consultes per report i dona suport al disseny per les seves unions. Permet data sources que no siguin de Java com CSV, Excel, Hadoop Hive, Hibernate, Mondrian. I s'ofereix serveis web. Servei gràfic de disseny de consultes.	Permet calendaris data-picker per tipus de dates, es poden especificar valors per defecte, disponibles drop-down list boxes, radio buttons, check boxes i como boxes.	És el més obert, permet templates, llibreries definides per l'usuari, definició d'estils de colors, fonts, bordes, marges, i codi CSS.	Pentaho
JasperReport	Permet les mateixes funcionalitats que Birt però les notes les fa com un informe a part. Es taules de continguts són més difícils de dissenyar.	A diferència de Birt, no dona suport per la unió de multiples data sources i la seva generació només la permet via sub-reports o gràfics. Servei gràfic de disseny de consultes.	Permet calendaris data-picker per tipus de dates, es poden especificar valors per defecte, disponibles drop-down list boxes, radio buttons, check boxes i como boxes.	Té les mateixes característiques que Birt sols que les llibreries definides per l'usuari l'ús no està tant ben definit.	JasperSoft
Pentaho Report Designer	Permet la generació de codi de barres, facilitat d'ús de les taules de continguts però no permet disseny de notes ni treball amb taules.	Té les prestacions de Jaspersoft amb la diferència que dona suport en la unió de varis data sources a través de Pentaho Data Integration. No permet Hibernate com a data source i ofereix web services per a PDI només	Permet calendaris data-picker per tipus de dates, es poden especificar valors per defecte, disponibles drop-down list boxes, radio buttons, check boxes i como boxes.	Té les mateixes característiques que Birt sols que les llibreries definides per l'usuari l'ús no està tant ben definit.	Pentaho
Microsoft Power BI Report	És un dels més complets en l'edició de informes i molt àgil a l'hora de fer-lo servir.	Permet moltes connexions a origen de dades es poden visualitzar per categories o tots alhora. Tampoc permet la connexió amb Hibernate.	Permet calendaris data-picker per tipus de dates, es poden especificar valors per defecte, disponibles drop-down list boxes, radio buttons, check boxes i como boxes.	Es pot utilitzar la API de Power BI per a la reutilització de codi ja generat.	Microsoft Dynamics, Salesforce, Google Analytics, Microsoft Excel.

II.lustració 23: Característiques dels informes

8. Minería de dades

La minería de dades és el conjunt de tècniques i tecnologies que ens faciliten l'exploració de grans bases de dades, en concret Data Warehouse dins el BI, d'una forma automàtica o semiautomàtica i el seu objectiu es localitzar patrons repetitius o de certes tendències que puguin donar explicació al comportament de les dades en un determinat context. En definitiva, ens ajuda a poder entendre el contingut d'un repositori de dades.

D'alguna forma, la informació que està a les bases de dades es podria considerar matèria primera bruta, sense analitzar. En el moment que algú li atribueix un significat passen a convertir-se en informació i quan aquesta informació algú li dona una interpretació i això representi un model agregat, llavors tindrem coneixement.



II.lustració 24: Procés Data mining

Encara que el procés de minería de dades pot ser diferent, hi ha un procés comú a tots ells que es sol compondre d'aquestes quatre etapes principals:

- **Determinació dels objectius:** Delimitar els objectius del client sota la orientació d'un especialista en data mining.
- **Preprocessament de les dades:** Selecció, neteja, reducció i transformació de les bases de dades. Aquesta etapa sol suposar un 70% del temps total del projecte de data mining.
- **Determinació del model:** Es comença realitzant un anàlisi estadístic de les dades per passar-ho després a un visualitzat gràfic.
- **Anàlisi dels resultats:** Es on verifiquem si els resultats obtinguts son coherents amb el que s'esperava. El client determina si l'anàlisi li aporta nou coneixement i li permet prendre noves decisions.

9. Quadre de comandament integral

Els quadres de comandament són eines que ens permeten visualitzar els indicadors (KPI) empresarials. A més, ens permeten monitoritzar, controlar i gestionar els processos de la nostra organització a través de codis que presenten avisos i per tant ens permeten una visió del rendiment de l'empresa.

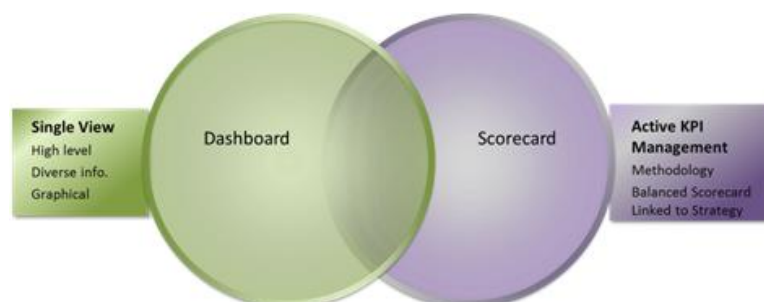
Aquests avisos ens són de gran ajuda ja que ens indiquen el compliment i l'eficàcia de continguts i ens permeten veure si l'activitat diària està alineada amb l'estratègia empresarial o també ens permet veure que està succeint i amb això podem arribar a prendre mesures correctores si es dona el cas.

Segons la seva funció podem trobar la següent classificació:

- **Quadre de comandament operacional:** Ens ajuda en l'execució dels processos.
- **Quadre de comandament tàctic:** Ens mostra la informació que ajudarà a controlar els processos.
- **Quadre de comandament estratègic:** Intervé en la gestió del procés per la consecució final dels objectius.

A més, segons la funció del seu contingut també podem especificar les següents categories:

- **Business Activity Monitoring (BAM):** Mostra en temps real la informació de caràcter operacional i tàctic fent ús dels KPI. Donen suport a la presa de decisions a curt termini.
- **Dashboarding:** Mostren informació sense comparar-la amb els objectius proposats. O sigui, amb ells només podem veure els KPI. Ens ajuda a identificar l'origen d'una dada positiva o negativa.
- **Scoreboarding:** Mostren informació estratègica i estan orientats a mostrar objectius, llavors, a més d'oferir els indicadors KPI, permet emmagatzemar en el sistema el KGI.
- **Balanced Scorecard:** Constitueix una metodologia de gestió estratègica completament independent.



II.lustració 25: Dashboard i Scorecard

10. Business Intelligence vs Big Data

BI i Big Data són dues tecnologies que serveixen per analitzar dades i ajudar a les empreses a prendre decisions tot i que els dos sistemes difereixen tant en la forma com ho fan, com en el tipus de dades que utilitzen.

A continuació podeu observar el format que treballa cadascun d'aquests sistemes que ens servirà com una comparació de la seva forma de treballar:

- **Business Intelligence:** es basa en l'agrupació de totes les dades empresarials en un servidor central després de depurar i treballar totes les dades a traspasar al DW i en la utilització de cubs multidimensionals (OLAP).
- **Big Data:** emmagatzema les dades en un sistema de fitxers distribuït i en un entorn més segur i més flexible, es centra en l'anàlisi de la dada i això permet manipular quantitats més grans de informació de forma àgil i a més pot analitzar dades en diferents formats, ja siguin estructurats o no, les dades processades poden provenir de històrics o de fonts en temps real i la forma de treballar fent ús del processament paral·lel massiu (MPP) permet millorar la velocitat d'anàlisi.

El Big Data ha aparegut degut als nous avanços tecnològics, BI estava pensant per un model més tradicional i amb l'aparició dels nous serveis al núvol, de les xarxes socials i les noves possibilitats d'interconnexions d'aparells a través de GPS, *Smartphones*, televisors, entre altres ha fet que es creessin noves necessitats però això no vol dir la desaparició de BI sinó que hem guanyat un nou sistema d'anàlisi de dades amb el Big Data.

11. Eines Business Intelligence

11.1 Introducció

Arribats a aquest punt, ja coneixem les diferents parts que formarien un projecte de Business Intelligence al igual que algunes de les eines més populars actualment, així doncs, en aquest apartat es procedirà a explicar i analitzar els diferents paquets integrats existents.

En concret, l'enfocament es farà des dels paquets integrats existents ja que ens donen la funcionalitat de tot el procés BI que hem analitzat prèviament, es donarà una visió de com s'hi treballa, de la seva agilitat, del tipus de llicència de què disposen entre altres característiques.

És cert que ens hem centrat més en paquets Open Source degut als seus avantatges econòmics però abans de continuar farem un parèntesis per veure els avantatges que ens poden oferir els paquets Open Source envers els paquets amb llicència:

- **Open Source:**

- ✚ *Avantatges:*

- Podem obtenir el software sense cap cost.
 - Les eines són molt flexibles.
 - Les eines son compatibles amb varis softwares existents al mercat actual.

- ✚ *Desavantatges:*

- No es disposa d'un manual d'usuari que permeti donar suport al software, tot i que podem trobar molt suport en línia.
 - No ens dona garantia de servei.
 - No existeixen usuaris especialistes que ens puguin ajudar directament.

- **Amb llicència:**

- ✚ *Avantatges:*

- Tenim la garantia de les empreses que distribueixen l'aplicació.
 - Eines fàcils d'utilitzar.
 - Hi ha persones especialitzades en la manipulació d'aquest software que ens donaran suport sempre que sigui necessari.

- ✚ *Desavantatges:*

- Cost elevat.

En l'anàlisi de les diferents eines es preveu una competència important entre les empreses que venen les seves aplicacions envers els productes de lliure distribució i en aquest cas s'està observant que algunes per tal de vendre el seu producte, ofereixen una part d'aquest de forma gratuïta però en canvi la resta dels complements dels productes són amb cost i això fa que algunes aplicacions no siguin del tot gratuïtes.

11.2. Suites Business Intelligence

En aquest apartat es descriuran les diferents suites que es fan servir actualment a les empreses. S'intentarà donar descripció als mateixos ítems entre aplicacions però es possible que alguns variïn per manca de poder-hi trobar la informació tot i així es pretén ser el més fiable i explícit possible per intentar fer d'aquest projecte una eina orientativa i que sigui fàcil de consultar-la.

Al final us podreu trobar un breu resum descriptiu que compararà resumidament tot el que es parlarà a continuació.

11.2.1 PENTHAO BUSINESS ANALYTICS

1.- Desenvolupador

Pentaho Corporation
Fundador: Richard Daley
Oficines centrals: Orlando, Florida, Estats Units
Web oficial: <http://www.pentaho.com/>

2.- Descripció

És una de les eines més popular i conté un conjunt de programes lliures que generen intel·ligència empresarial. Inclou eines integrades per generar informes, mineria de dades, ETL,

Pentaho és un d'aquells paquets mixtes i per tant té una part que és Open Source amb les funcionalitats mínimes necessàries per fer un anàlisi empresarial, de tota manera, té molts components, plugins que ja no són gratuïts i ajuden a tenir un millor rendiment a l'aplicació base.

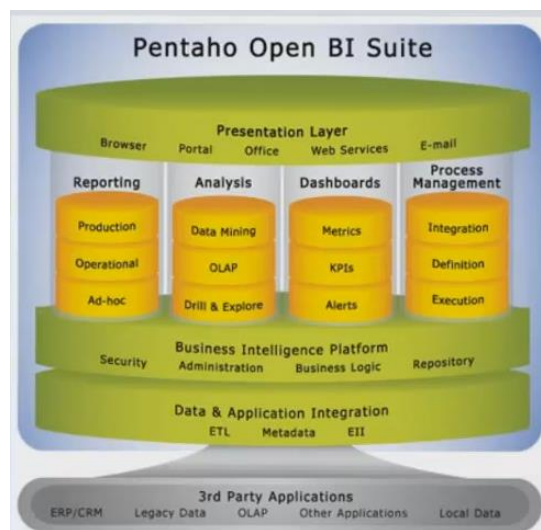
Aquesta darrera part té suport d'especialistes, el que permet realitzar consultes a tècnics que donaran una resposta ràpida i eficient a qualsevol dubte que sorgeixi.

3.- Característiques generals

Les eines a utilitzar han de ser configurades i integrades als sistemes de l'empresa de forma manual. To i que es pot comprar la versió Enterprise que incorpora un instal·lador que facilita molt la feina.

Els motors de base de dades amb què treballa són:

- *Codi Obert*: MySql, PostgreSQL, monetdb, LucidDB, entre altres.
- *Llicència comercial propietària*: Oracle, Microsoft Access, IBM DB2, Microsoft SQL Server, SAP ERP System,...



Estructura Pentahao

Les funcions principals són la generació d'informes, creació de dashboards i scorecards i anàlisis OLAP.

Funcions secundàries serien les de tractar les dades mitjançant processos ETL.

Disposa d'una interfície gràfica molt potent, fàcil de fer anar ja que permet arrastrar qualsevol element a la pantalla principal amb la tecnologia *Drag & Drop*.



II. Il·lustració 26: GUI de Pentaho

Tenim disponibles diferents components com per exemple Pentaho BI Server o Kettle.

És un paquet compatible amb els sistemes Windows, Linux i OS X.

Referent a les actualitzacions i manteniment del soft tenim a Pentaho Community i Pentaho Corporation que s'encarreguen d'aquestes feines.

4.- Avantatges

- Facilitat en el seu ús.
- És compatible amb altres eines Open Source.
- Té una gran comunitat online que dona suport continuat.
- Disposa de complements de codi lliure que es poden utilitzar tot i que té altres de pagament també molt funcionals.

5.- Inconvenients

- Alguns complements són de pagament i per tant amb llicència privada.

6.- Informació addicional

Hi ha infinitats de vídeo tutorials i webs on expliquen el procés d'instal·lació.

La descàrrega del software gratuït es pot fer des de la següent URL:

<http://community.pentaho.com/>

11.2.2 JASPERSoft

1.- Desenvolupador

TIBCO Software, Inc

Fundador: Guilio Toffoli (iReport)

Oficines centrals: Palo alto (California)

Web oficial: <https://www.tibco.com/>

2.- Descripció

JasperSoft és una eina de BI que permet integrar els diferents sistemes de dades, persones i processos per guanyar eficiència. A més, permet augmentar la intel·ligència de negoci amb la captura i processament de la informació per prendre decisions ràpides i eficients.

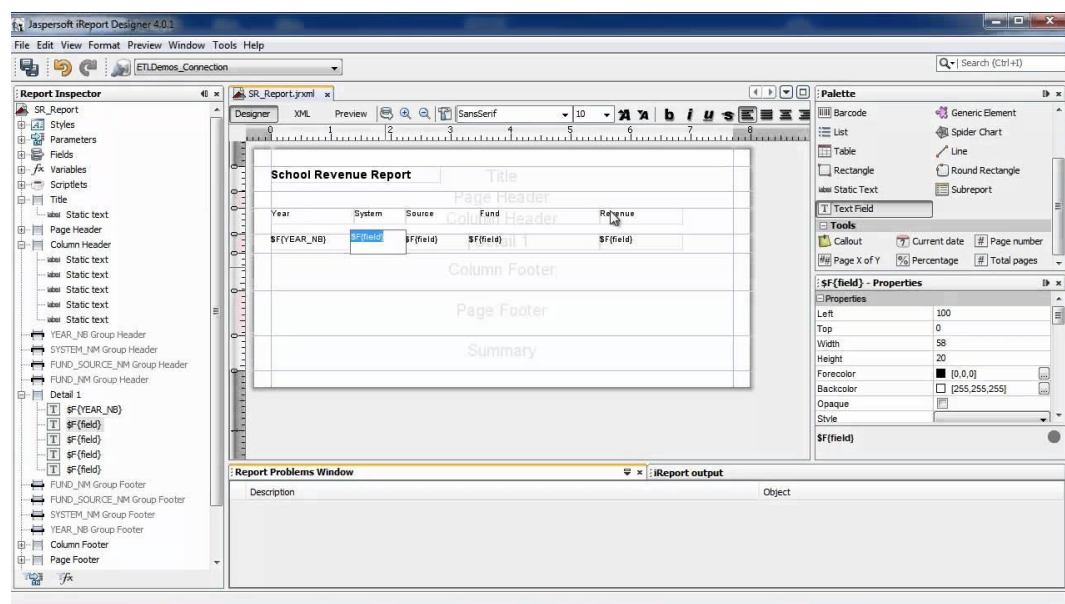
L'eina serveix principalment per la generació d'informes amb alta qualitat i detall, la generació de Dashboards i Scorecards i a més permet exportar els informes en diferents formats ja explicats a l'apartat 7.

3.- Característiques generals

Les seves funcions principals són la de generació d'informes i la creació de Dashboards i Scoreboards, també treballa amb processos ETL però no és la seva acció principal.

Té l'avantatge de presentar-se en Llicència LGPL, Eclipse y AGPL i cobreix perfectament les necessitats que exigeix un projecte de BI.

La seva interfície gràfica es molt senzilla i agradable de treballar-hi. Un dels aspectes que hi podem trobar serien com a la figura següent:



II. Il·lustració 27: GUI de JasperSoft

Aquesta eina és compatible amb els sistemes operatius més tradicionals com són Windows, MacOS i Linux.

Disposa de servei de manteniment i actualitzacions i els suports a l'usuari s'obtenen a partir d'una gran comunitat de suport molt activa que ajuda a resoldre qualsevol problema que es plantegi, a més, d'una quantitat extensa de vídeo tutorials.

Diposen d'una comunitat oficial que la podeu trobar a:

<http://community.jaspersoft.com/>

JasperSoft disposa d'una modulació d'aplicacions que es poden integrar entre elles donant més funcionalitat a tot el paquet.

Alguns dels productes que ens ofereix són els següents:

- Informes i anàlisis integrats a la pròpia aplicació de l'organització.
- Informe i anàlisis per el negoci.
- Informes de producció.
- Anàlisis mòbils.
- JasperSoft per a Docker.
- Anàlisis de Big Data.
- Anàlisis al núvol (Té un cost addicional de 1€/hora).

4.- Avantatges

- Software lliure.
- Inclou processos ETL.
- Es realitzen actualitzacions i manteniments constants.
- És fàcil resoldre dubtes a través de la comunitats d'usuaris i les eines d'ajuda que circulen per la xarxa.
- És pot fer servir per generar informes, dashboards i scorecards tant amb equips fixes com a mòbils.
- Té una gran diversitat de formats de sortida.

5.- Inconvenients

- No té gaires coses en contra però una que podríem destacar es que per obtenir un gran profit de l'aplicació cal que l'usuari en sigui una mica expert.

6.- Informació adicional

Podeu descarregar l'aplicació des de la URL:
<https://www.jaspersoft.com/es/tres-formas-de-probar-su-software-de-bi>

11.2.3 ECLIPSE BIRT PROJECT

1.- Desenvolupador

The Eclipse Foundation, Inc
BIRT: Business Intelligence and Reporting Tools
Oficines centrals:
Amèrica: Canadà
Àsia, Pacífic i Japó: Sydney
Europa, Middle East i Àfrica: Munich(Grasbrunn)
Web oficial: <http://www.eclipse.org/birt/>

2.- Descripció

BIRT és un projecte BI de codi obert amb llicència LGPL i ens proporciona capacitats de creació d'informes i de intel·ligència de negoci per a clients pesats (fat clients) i també per aplicacions web, especialment les basades en Java i Java EE.

És classificat com un software d'alt nivell i desenvolupat per una comunitat molt activa sense ànim de lucre. Qualsevol desenvolupador pot ajudar i per això tenen una web oficial per a ells que és: <http://developer.actuate.com/>

El projecte està patrocinat per Actuate amb contribucions de IBM i solucions de Innovent.

Gràcies a tot aquest suport, BIRT s'està desenvolupant contínuament.

L'objectiu del projecte és cobrir un ampli rang de necessitats de creació d'informes dins d'una aplicació típica i va des de la generació d'informes operacionals fins a multi-dimensional analític en línia (OLAP).

BIRT té dos components principals:

- Dissenyador d'informes visuals dins d'Eclipse IDE per crear informes BIRT.
- Un component de rutina per generar informes que poden posar-se en ús de qualsevol entorn de JAVA.

Els dissenys d'informes en aquesta aplicació es fan en XML i poden accedir diverses fonts de dades diferents incloent SQL Databases, JDO Datastores, JFire Scripting, POJOs, XML i serveis web.

3.- Característiques generals

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generació d'informes operacionals fins a multi-dimensional analític en línia (OLAP).

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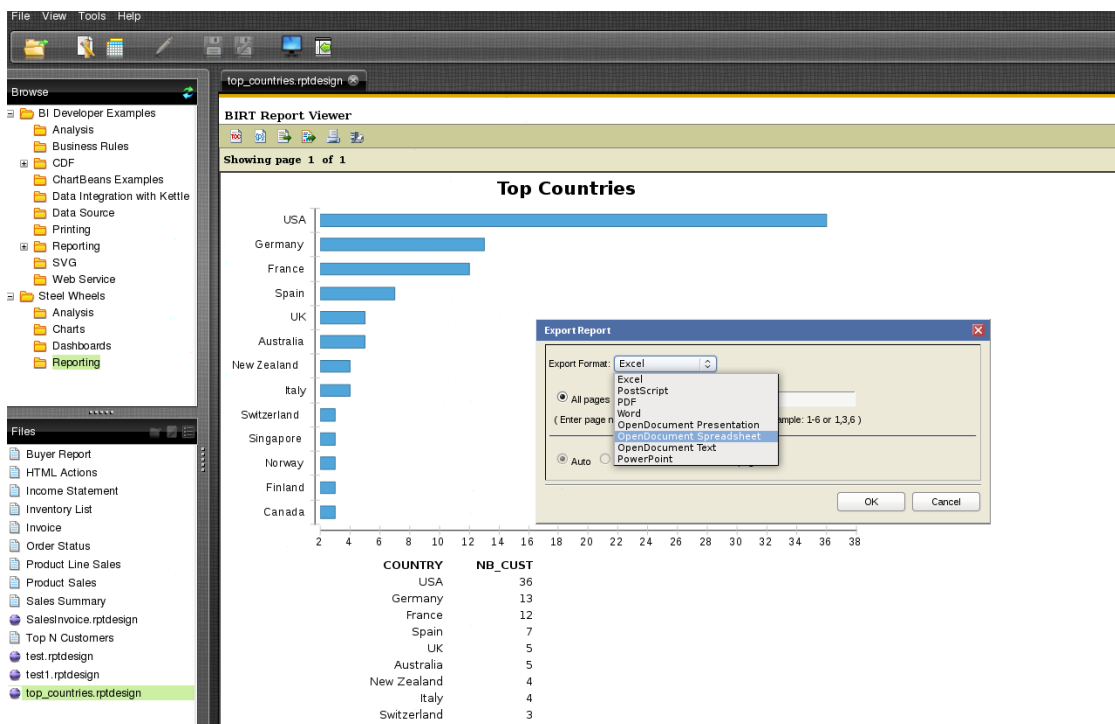
A més, disposa d'una interfície gràfica de Eclipse i els informes generats disposen de GUIs personalitzades.

Hi ha disponibles una diversitat de components i plugins que cobreixen qualsevol necessitat.

És compatible amb tots els sistemes operatius i per tant, el fa molt competitiu.

En quant al servei de manteniment i actualitzacions, Eclipse Community és qui se'n fa càrrec i estan en constant creixement.

Tot seguit podeu visualitzar com és la interfície de Eclipse BIRT:



II.lustració 28: GUI BIRT

4.- Avantatges

- Llicència EPL amb suport i desenvolupament constant.
- Facilitat d'integrar-se amb altres eines.
- Cobreix tot tipus de necessitats per a solucions BI.
- Es troben exemples, vídeos i tot tipus d'ajut per al seu aprenentatge.

5.- Inconvenients

- Per aprofitar al màxim el seu potencial cal que l'usuari tingui experiència en l'ús d'aquesta eina.

6.- Informació addicional

Es pot descarregar l'aplicació a la següent URL:
<http://download.eclipse.org/birt/downloads/>

11.2.4 Qlik Sense

1.- Desenvolupador

Qlik – Provider of Qlik View and Qlik Sense

Oficines centrals: Radnor, Pennsylvania

Web oficial: <http://www.qlik.com/us/>

2.- Descripció

És una eina de visualització i generació de Dashboards i Scorecards i permeten la gestió del negoci en temps real. Té el gran avantatge que permet visualitzar les dades des de qualsevol dispositiu ja sigui mòbil o de sobretaula.

Té diferents productes entre ells la versió gratuïta de Qlik Sense Desktop que permet la generació d'informes des de qualsevol dispositiu, la resta de funcionalitats són sota llicència comercial.

És una eina molt senzilla i amb una visualització molt intuïtiva que permet explorar i analitzar les dades de l'empresa amb un temps molt reduït.

S'utilitzen les eines *Drag & Drop* per arrastrar informació entre els diferents mòduls i així d'una forma molt senzilla es pot crear una consulta, un informe,...

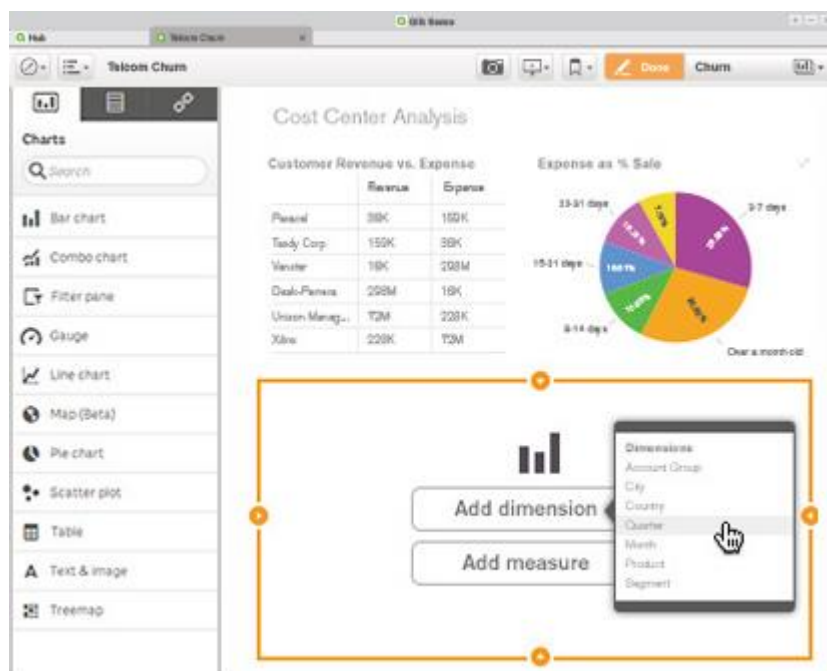
3.- Característiques generals

Les funcions principals de l'aplicació és la generació dels informes, dashboards i scorecards, d'altra banda permet la creació de consultes necessàries per a la seva utilització i mostra de dades.

Disposa de biblioteques integrades que permeten la reutilització de dades, mètriques i objectes.

Aquesta aplicació té una llicència mixta donat que hi ha complements que són gratuïtes com el QSDesktop però en canvi la majoria dels altres són de pagament amb versions de prova gratuïtes durant uns 60 dies.

Disposa d'una interfície gràfica com la que podeu veure a continuació:



II. Il·lustració 29: GUI Qlik Sense

Es compatible amb sistemes operatius Windows (només de 64 bits) i Windows Server. Els software de tercers pot requerir la instal·lació de paquets específics de servei per poder-lo instal·lar.

Disposa d'un servei de manteniment i actualització constant, a més, es pot trobar diferents comunitats d'usuaris que ajuden amb bastanta rapidesa i es pot trobar gran quantitat de manuals, exemples i vídeo tutorials a la mateixa web oficial.

Es pot accedir al seu propi fòrum a la URL:

<https://community.qlik.com/community/qlik-sense>

4.- Avantatges

- Creació ràpida i senzilla dels informes, dashboards, scorecards.
- La informació es fàcilment exportable.
- Hi ha la versió Desktop que permet compartir la visualització de les dades d'una forma senzilla i pràctica.
- Les consultes es realitzen sense instruccions SQL i es reconeix el text pla.

5.- Inconvenients

- Llicència Mixta, o sigui, privada per la majoria de components i pública en escassos programes.

- Només funciona en sistemes operatius Windows.
- No hi ha massa qualitat en els dissenys dels dashboards i scorecards.
- Cal registrar-se per fer-ne les descarregues de qualsevol component.

6.- Informació addicional

En aquest apartat vull esmentar que Qlik ha estat nomenat líder en BI per setè any consecutiu i per tant és líder en el Quadrant Màgic de Gartner i model que pretén informar de la situació del mercat BI de l'any en curs.

Es pot descarregar la versió oficial a la URL oficial:

<http://www.qlik.com/es-es/try-or-buy>

L'eina es pot fer servir en Windows i Microsoft Windows Server. Té Llicència Mixta.

11.2.5 Tableau

1.- Desenvolupador

Tableau software

Oficines centrals: Seattle, Washington, Estats Units

Web oficial: <https://www.tableau.com>

2.- Descripció

És una eina molt fàcil de fer anar. Els usuaris que la utilitzin no els cal coneixements de programació ja que la forma de fer-lo anar és molt senzilla i intuïtiva i els diferents mòduls de què disposa n'hi ha que són gratuïts i d'altres de pagament.

És una eina molt acceptada a nivell general gracies a la seva potencialitat i el poc cost que suposa comparant-ho amb els altres productes que existeixen al mercat.

3.- Característiques generals

El producte busca dins de bases de dades relacionals, cubs OLAP, bases de dades al núvol i en fulls de càlcul i llavors genera un número divers de tipus de gràfics.

Dóna un accés instantani a les dades independentment dels orígens de dades que tingui l'organització (Excel, bases de dades o arxius propis).

El propi usuari és qui gestiona i distribueix els seus anàlisis, per enviar-ho o compartir-ho a través de versions Reader (gratuït) i Server (web).

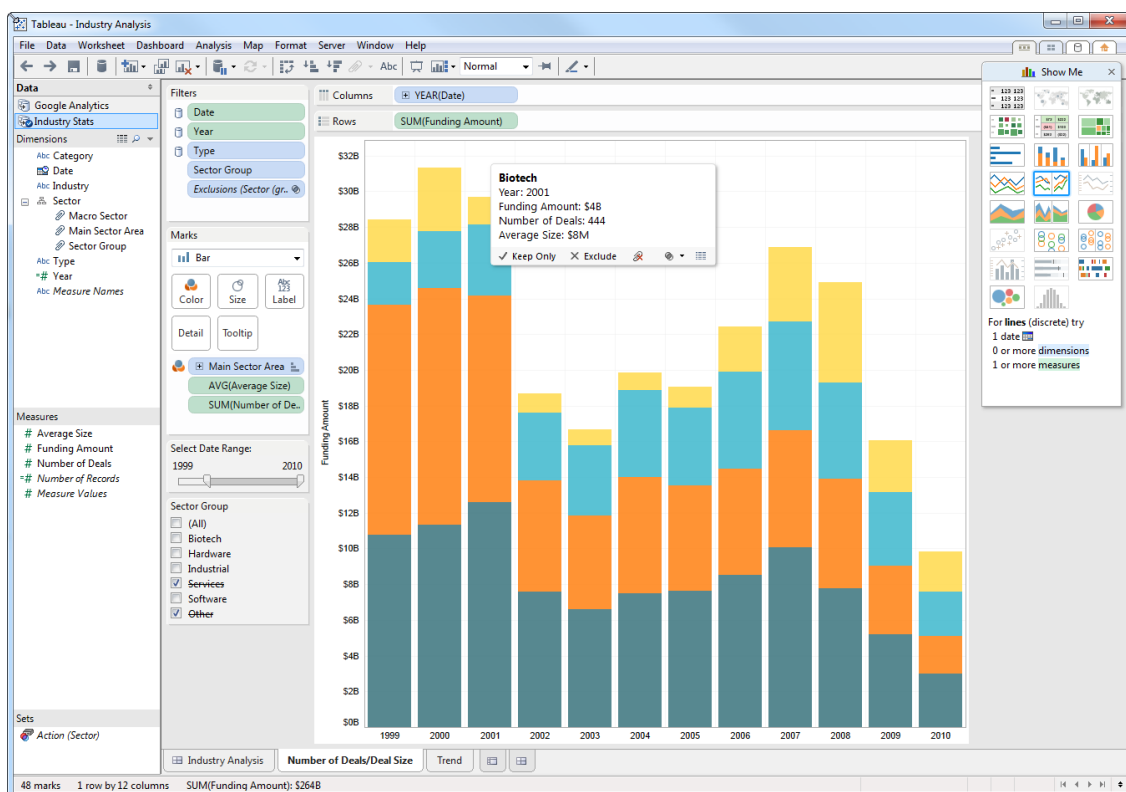
Tableau té les versions:

- Desktop: Per a tothom. Senzilla de fer anar, molt ràpida de configurar amb el sistema *Drag & Drop*, quadres de comandament brillants amb possibilitat de combinar varis anàlisis en un sol document, permet una connexió directa i no requereix programació, generació de *Mashups* perfectes amb diferents combinacions d'origen de les dades.
- Server: Per a empreses. Portals web interactius, sense desenvolupaments informàtics, accés molt ràpid a milions de dades, barreja de diferents dades amb un sol clic, possibilitat d'ordenar i filtrar dades en temps real.
- Digital: Per a integració en sides de notícies i informació. Millora la presentació de la pàgina per captar millor l'atenció dels visitants amb les dades interactives i dona un servei

personalitzat on cada client pot buscar la informació que li interessi.

- Public: Per integració en blogs. És un servei gratuït, no cal ser programador, permet que els usuaris facin exploració de dades en línia i es poden compartir les visualitzacions.

La interfície gràfica que té Tableau es com la imatge que teniu a continuació:



II.Iustració 30: GUI de Tableau

4.- Avantatges

- Permet geolocalització personalitzada.
- Hi ha 5 formes d'accedir als seus productes: Desktop (edició professional i personal), Server, Online, Reader i Public. (els dos darrers són gratuïts per l'usuari)
- Funcionalitat de mapes i es pot traçar qualsevol coordenada de latitud i longitud.
- És molt intuïtiu i fàcil d'utilitzar
- El preu està per sota de la mitjana del mercat.

5.- Inconvenients

- Per fer la descàrrega et demana el correu electrònic.
- La funcionalitat de mapes es criticada per ser massa centrada en Estats Units.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<https://public.tableau.com/en-us/s/download>

L'eina es pot fer servir en Windows i MAC OS X Server. Té Llicència Mixta.

11.2.6 SAP BI

1.- Desenvolupador

SAP Sites

Oficines centrals: Palo Alto

Web oficial: <https://www.sap.com/spain/solution.html>

2.- Descripció

SAP BI és una aplicació que integra la informació que l'empresa necessita, aquesta informació pot venir del propi sistema SAP instal·lat a l'empresa, client, o també de fonts externes com serien; aplicacions externes, documents annexes, informació provinent de la web.

A més, un cop integrada la informació, SAP BI fa exploració de dades i és aquí on l'usuari en fa ús i la pot convertir en informació i posteriorment en coneixement i presa de decisions en l'àrea de negoci de l'empresa.

SAP BI ens permet prendre decisions en base a un anàlisi d'informació de diferents fonts, aquest treballa sobre el model de integració i exploració de dades i dins d'aquest model hi podem trobar els següents mòduls.

- Les bases de dades SAP BI
- Bases de dades annexes (NoSAP)
- Les aplicacions integrades (SAP i NoSAP)
- Els documents plans.
- Integració Web-XML

3.- Característiques generals

Una de les característiques importants amb que treballa SAP BI és els infocubs; són les estructures més importants d'informació que estan formades per informació multidimensional (Cubs) i conté dimensions, ratis o mesures.

SAP una de les seves feines principals és la de crear els infocubs, modificar-los i donar-los el respectiu manteniment quan son sol·licitats per les empreses.

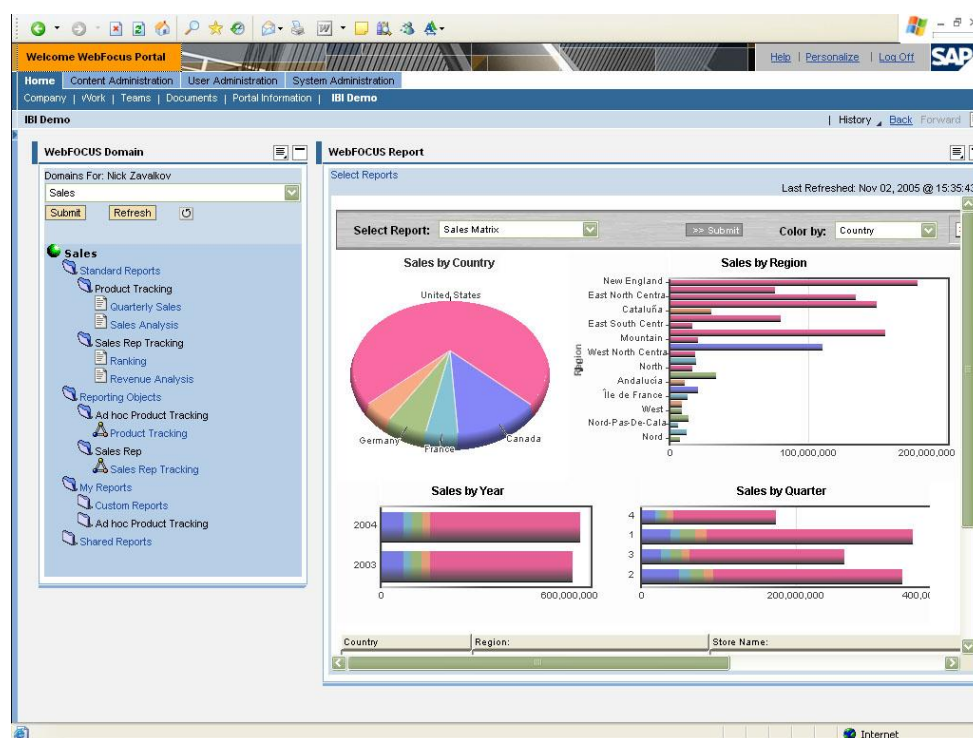
Es disposa també del mòdul SAP BW que és el magatzem de base de dades propi d'on s'extreu informació de les operacions de gestió utilitzada en el propi sistema amb la finalitat d'obtenir informació sobre la gestió i així poder definir els diferents escenaris i/o presa de decisions.

D'altra banda també existeix SAP BEx (SAP Business Explorer) és una eina per a la generació d'informes que permet fer anàlisis mitjançant reports.

El servei de suport és excel·lent es dona suport des dels propis distribuïdors de SAP i de les diferents comunitats d'usuaris que es pot trobar per la xarxa i a la seva pròpia web.

Els mòduls són de pagament tot i que es disposa de versions de prova temporals.

La interfície gràfica que té SAP BI es com la imatge que teniu a continuació:



II. Il·lustració 31: Interfície SAP

4.- Avantatges

- La utilització dels infocubs permet al negoci donar respostes clares al seu model d'empresa.
- Possible modificació del model de negoci a partir de la informació aportada per tot el model SAP i SAP BI/BW.
- La integració de tot el model de negoci amb un sol ERP i els mòduls necessaris per l'anàlisi BI.
- L'actualització constant i el progrés de l'aplicació.
- Consulta ràpida a partir dels experts de SAP i a través de comunitats. SAP té la seva a pròpia a: <https://www.sap.com/community/topic/bi-platform.html>

5.- Inconvenients

- Els mòduls són de llicència privada tot i que hi ha versions de prova disponibles.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<https://www.sap.com/developer/trials-downloads.html>

L'eina es pot fer servir en Windows i MAC OS X, Linux. Té Llicència Comercial.

11.2.7 Cognos Analytics

1.- Desenvolupador

IBM Cognos

Oficines centrals: Ottawa, Ontario

Web oficial: [Cognos Analytics de IBM](#)

2.- Descripció

Cognos combina la funcionalitat de diferents productes com serien ReportNet, PowerPlay, Metrics Manager, Noticecast i DecisionStream.

Evita la generació de duplicats dins la organització gràcies al treball des del cloud, aportant a més flexibilitat i rapidesa en general.

És una eina centrada a la gestió i creació de dashboards i scorecards i proporciona un gran número d'opcions per a la creació de solucions amb entorns amigables i fàcils de gestionar.

3.- Característiques generals

Les funcions generals del paquet integrat és la de generar coneixement per a l'empresa a base de la creació de dashboard, scorecards i informes disponibles des de diferents entorns i fins i tot estan aquests online o offline.

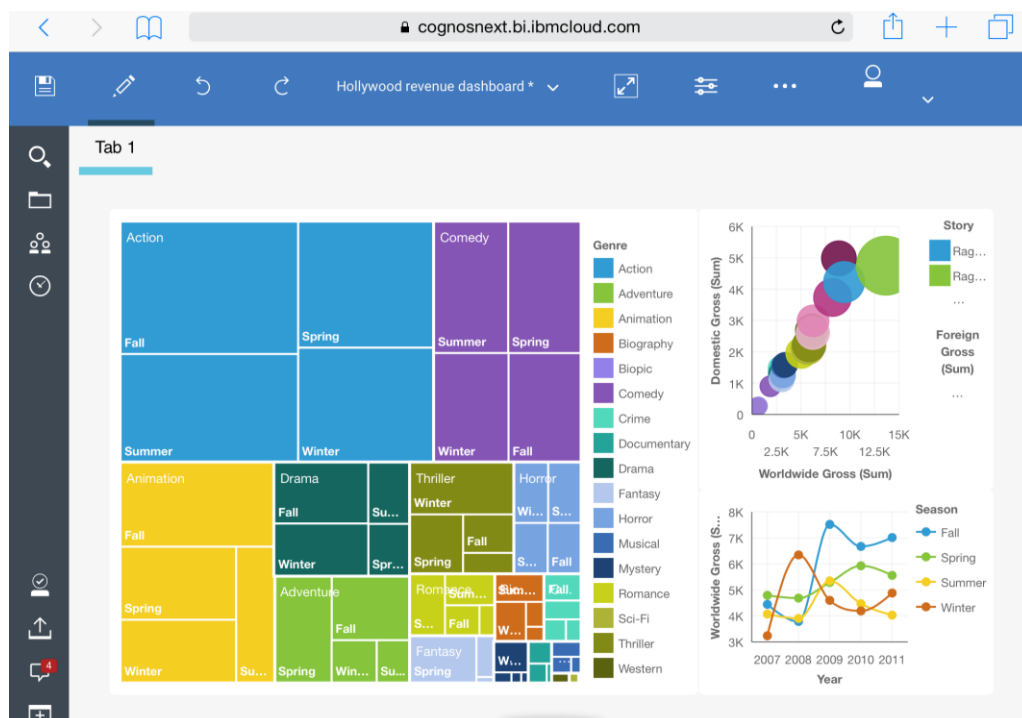
Els informes, panells de control i altres funcionalitats mòbils i d'anàlisi estan dissenyats per integrar-se entre sí i amb moltes solucions de tercers, analítica predictiva i també les principals plataformes de Big Data.

Tot i així podríem dir que la seva condició de paquet sota llicència comercial pot suposar un inconvenient per les empreses petites donat la inversió que això els pot suposar.

Disposa de diferents productes:

- Cognos Analysis for Microsoft Excel
- Cognos Analytics
- Cognos Business Intelligence for Linux on System z.
- Cognos Business Intelligence for z/OS
- Cognos Mobile

La interfície gràfica que té Cognos Analytics es com la imatge que teniu a continuació:



II. Il·lustració 32: Interfície Cognos Analytics - IBM

4.- Avantatges

- Interfície intuïtiva molt simple
- Suport per experts i comunitats
- Possibilitat de crear informes online i offline.
- Treballar en un únic entorn.
- La comoditat del cloud i un govern complet que evita duplicats en general bastant costosos.

5.- Inconvenients

- Es paquet BI amb cost i amb versió de prova temporal.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<https://www.ibm.com/es-es/marketplace/business-intelligence/purchase>

L'eina es pot fer servir en els sistemes operatius més comercials i en Solaris te una àmplia integració i suport per a treballar-hi. Té Llicència Comercial i demostracions de prova.

11.2.8 Board international

1.- Desenvolupador

Board International

Oficines centrals: Lugano, Switzerland

Web oficial: www.board.com

2.- Descripció

Board anomena *Intel·ligència de gestió* al seu kit d'eines integrat dins un entorn interactiu que fa que la creació d'autoservei de solucions per a taulers de control, planificació financera i operacional, anàlisis i informes sigui fàcil i intuïtiva.

3.- Característiques generals

És una eina molt popular i permet la creació de dashboards, scorecards i la generació d'informes entre altres funcionalitats d'administració que permet realitzar.

La filosofia de Board és tenir la BI, la gestió de l'empresa i anàlisis tot en una mateixa plataforma per evitar-ne les duplicitats i ser el més ràpid i eficient en les respostes.

Utilitza la tecnologia *Drag & Drop* en les seves interfícies gràfiques i permet la creació d'aplicacions sense generar res de codi.

En quant a les bases de dades, unifica tota la informació que prové d'elles en una sola vista lògica el que permet una fàcil gestió de les mateixes. Les actualitzacions són immediates.

La interfície gràfica que té Board es com la imatge que teniu a continuació:

SALES PLANNING

II. Il·lustració 33: Interfície Board

4.- Avantatges

- Es connecta a gairebé qualsevol base de dades.
- Facilitat en la creació de quadres de comandament.
- Té molt bona relació qualitat-preu
- Suport al client considerablement bo.
- Es pot crear qualsevol tipus d'aplicacions sense necessitat de codi.
- Es pot treballar al núvol o en local.
- Es crea una vegada i es pot distribuir a tots els punts.
- Facilitat d'ús.
- Unifica qualsevol font de dades en una sola vista lògica.
- Unifica totes les funcionalitats necessàries per la presa de decisions en una sola plataforma.
- Sincronitzacions immediates amb les bases de dades.
- Utilitza la funcionalitat *Drag & Drop*.
- Permet als usuaris verificar al instant els resultats que generen.

5.- Inconvenients

- L'aplicació es ven sota llicència comercial i a vegades pot ser massa costós per el petit empresari. Es disposen *demos* per a provar el producte.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<http://www.board.com/es/producto>

L'eina es pot fer servir en els sistemes operatius Windows i web.

Té Llicència Comercial i demostracions de prova.

11.2.9 MicroStrategy

1.- Desenvolupador

MicroStrategy.

Oficines centrals: Virginia, Estats Units.

Web oficial: <https://www.microstrategy.com/es/>

2.- Descripció

MicroStrategy és un software que permet crear informes i anàlisis de dades emmagatzemat en una base de dades relacional o d'altres fonts.

La tecnologia utilitzada és ROLAP tot i que també suporta MOLAP.

En les últimes actualitzacions ha millorat en la creació àgil dels quadres de comandament.

3.- Característiques generals

En la versió 10 s'han millorat moltes coses, s'ha buscat la integració de tot el negoci, l'agilitat en el treball amb les dades, la seguretat en el sistema i la mobilitat entre altres. Això ha fet que MicroStrategy torni a competir amb els grans.

Permet fer servir qualsevol tipus de visualització de les biblioteques Java, a més, utilitza la capacitat dels mapes per la visualització i interacció amb dades de localització, és una aplicació escalable i permet ampliar les seves capacitats analítiques amb conjunts d'eines de tercers.

És una eina molt popular i permet la creació de dashboards, scorecards i la generació d'informes entre altres funcionalitats d'administració que permet realitzar. Utilitza també la tècnica *Drag & Drop* i no cal codificar.

Facilitat en la connexió amb diverses bases de dades mostrant la informació com si només en fos una.

Pot analitzar ràpidament Big Data fins a 50 vegades més ràpid fent ús de consultes HDFS (Hadoop Distributed File System) natiu directament contra Hadoop.

L'avantatge d'aquesta solució BI es que hi ha la versió Desktop que es gratuïta i la plataforma completa es pot demanar una demo abans de procedir a la seva compra.

La interfície gràfica que té Board es com la imatge que teniu a continuació:



Il.lustració 34: Interfície de Board

4.- Avantatges

- Seguretat en les dades.
- Escalabilitat provada.
- Existència de la versió Desktop gratuïta.
- Facilitat en la interconnexió de les bases de dades.
- No cal codificacions. Ús de la tècnica *Drag & Drop*.
- Amb la versió 10 es fa càrrega de dades en paral·lel per evitar els colls d'ampolla dels ODBC.
- Temps de resposta més ràpids.
- Suport continuat des de MicroStrategy i multitud de comunitats virtuals, vídeos, ... que resolen els problemes amb un curt període de temps.

5.- Inconvenients

- El fet de ser la plataforma de pagament fa que no tothom hi pugui accedir.
- Abans de la versió 10 la seva popularitat va anar baixant i ara està agafant posicions als seus competidors.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<http://www.board.com/es/producto>

L'eina es pot fer servir en qualsevol sistema operatiu i dispositius.

Té Llicència Comercial i demostracions de prova.

11.2.10 Domo

1.- Desenvolupador

Domo, Inc.
Fundador: Josh James
Oficines centrals: American Fork, Utah, Estats Units
Web oficial: <https://www.domo.com/>

2.- Descripció

És una paquet integral molt pràctic. Disposa de totes les seves funcionalitats al núvol donant gran rapidesa de resposta als usuaris que hi accedeixen des de qualsevol dispositiu.

Altament actualitzat tant a nivell d'aplicacions com de dades i rep un manteniment constant gràcies al gran equip de què disposa Domo.

Permet a més, que petits o grans desenvolupadors creïn Apps simples, àgils i que romanen a disposició de qualsevol usuari que la necessiti.

A més, a diferència d'altres competidors Domo no implica una despesa inicial.

3.- Característiques generals

La gran diferència de Domo es que s'executa en el núvol, allà hi té les bases de dades, les eines, els diferents connectors i l'accés a les Apps el que li dona grans recursos de rapidesa, API's, seguretat i mobilitat.

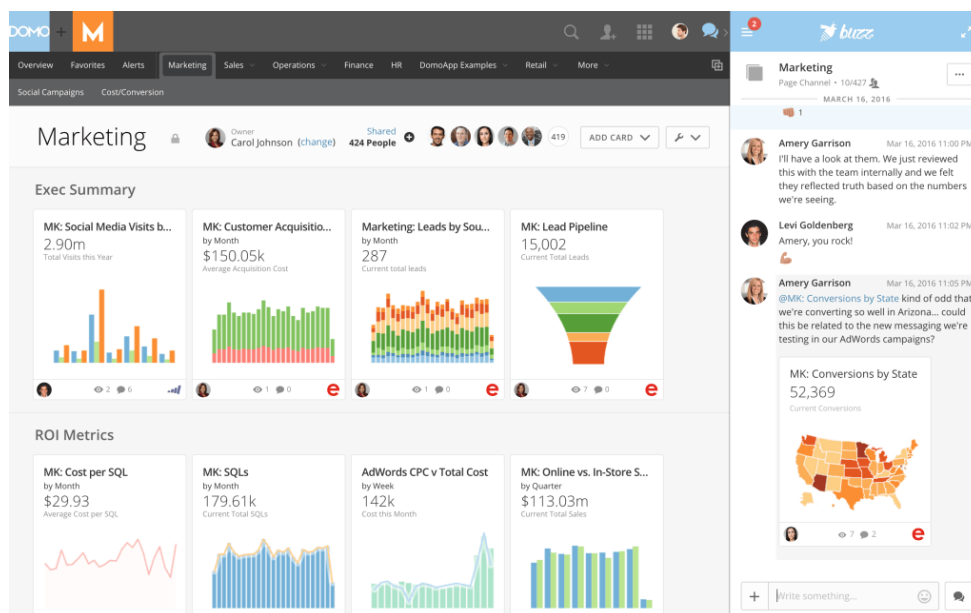
Disposa de moltes Apps creades per desenvolupadors, així que pots triar la més adient al teu negoci. Són molt senzilles de crear i per tant qualsevol persona amb un mínim coneixement les pot crear.

Es distribueix a partir d'una versió de prova i llavors hi ha un cost per usuari/mes no massa elevat, la qual cosa no implica un gran desembors inicial.

Pots crear dashboards, scorecards, et permet tenir una connexió continuada des de qualsevol lloc i el fet de treballar al cloud permet integrar totes les dades del negoci.

Es poden connectar dispositius físics i mòbils que tinguin els sistemes, Android, iPhone-iPad, iPhone, iPad, Mac, Windows, Web-based, Mobile Web App.

La interfície gràfica que té Domo es com la imatge que teniu a continuació:



Il·lustració 35: Interfície de Domo

4.- Avantatges

- Domo s'executa en el cloud, això permet resposta des de qualsevol lloc i dispositiu.
- Multitud d'Apps disponibles.
- Fàcil de trobar llocs on formar-se.
- Suports des de la mateixa empresa i comunitats, vídeos,...
- Seguretat en les connexions al núvol.

5.- Inconvenients

- La versió es de pagament mensual i per poder accedir a la versió de prova t'has d'enregistrar.

6.- Informació addicional

Es pot descarregar la versió oficial a la URL oficial:

<https://www.domo.com/talk-to-sales>

L'eina es pot fer servir en els sistemes operatius Windows i web. Té Llicència Comercial i demostracions de prova.

11.3 Resum de les eines

En aquest apartat es pot trobar un breu resum comparatiu de les eines que s'han analitzat en l'apartat anterior intentant remarcar aquelles que poden ser importants en la decisió del producte.

La valoració s'ha optat per donar-li una puntuació de 1 a 5 depenent de les acceptacions que s'ha pogut veure que tenen a dia d'avui.

1 → menys acceptació

2 → més acceptació

D'altra banda, a la hora de valorar els sistemes operatius amb què treballa, en cada apartat s'ha parlat més obertament de quins són però a la taula m'he centrat només amb els més comuns que serien Windows i Mac OS/X.

Comparativa i valoració de les diferents suites BI analitzades													
Suite	Llicència	ETL	OLAP	Generació d'informes	Creació Dashboard	Creació Scorecard	Components addicionals	Interfície GUI	Sistema operatiu Windows	Sistema operatiu MAC	Permet exportació de dades	Classificat segons informe Gartner 2017	Valoració 1-5 (menys a més)
Pentaho Business Analytics	Mixta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Nínxol	5
JasperSoft	Lliure	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	Visionaris	5
Eclipse Birt Project	Lliure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Nínxol	3
Qlik Sense	Mixta	✗	✗	✓	✓	✓	✓	✓	✓	✗	✓	Líder	5
Tableau	Mixta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Líder	5
SAP	Comercial	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Visionaris	5
Cognos Analytics	Comercial	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Visionaris	5
Board International	Comercial	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	Nínxol	4
MicroStrategy	Mixta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Visionaris	5
Domo	Mixta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Nínxol	5

II.lustració 36: Taula comparativa

12. Informe Gartner 2017

El món del Business Intelligence, tant empreses que tenen productes al mercat com els usuaris actuals o futurs, disposen de diferents informes de qualitat i acceptació per la xarxa que els pot orientar en l'elecció del producte més popular i/o eficient del mercat.

En concret, faig referència al informe Gartner que anualment fa un gran estudi de mercat de l'estat de les aplicacions, cap a quina direcció estan anant, els canvis i tendències actuals, en definitiva, és un informe de referència al qual he tingut present per fer aquest treball de fi de grau i que us he adjuntat en l'annexa d'aquesta memòria per qui el vulgui consultar. Es troba a la web i es gratuït.

El següent gràfic forma part de l'informe Gartner del 2017 i es pot visualitzar la situació dels productes tant aquells que són líders en el mercat com els visionaris o les eines nínxol.

Es pot observar que els líders del moment són Microsoft, Tableau i Qlik que té la versió Sense (comentada en el TFG) i la View.

II.lustració 37: Informe Gartner febrer del 2.017

13. Conclusions

Business Intelligence és un àrea on les empreses des de ja fa uns anys i actualment encara més, hi inverteixen per tal d'aprofitar al màxim tota aquella informació de dades de la qual disposen per tal de ser més competents dins del seu mercat.

Per això, una empresa que disposi d'un sistema d'informació d'aquest tipus i que estigui perfectament integrat en els seus sistemes de gestió i que a més disposi d'un bon equip que sàpiga fer anar aquestes eines i treure'n la informació necessària, adquireix un gran avantatge competitiu respecte les companyies que no en disposin.

Moltes de les empreses que encara no en fan ús és per la manca de temps en informar-se, formar-se i a vegades en el cost que pensen que això els suposarà i això fa que vagin perdent quota de mercat. I és per aquest motiu que em va sorgir la idea de fer aquest projecte, per posar en mans dels interessats la

informació tant d'aplicacions Open Source com de llicència privada que podrien implantar en les seves organitzacions.

Així doncs, en la primera part m'he centrat en informar de les diferents parts que forma un procés BI, ETL, Reports, ... i s'ha fet una comparativa de les diferents eines comentades amb els seus pros i contres per poder-ne fer una valoració visual bastant ràpida.

En la segona part, la que considero més important, s'hi ha descrit les Suites BI més importants d'avui dia i he seguit l'informe Gartner del 2017 per la seva selecció. De cada paquet s'extreu la mateixa informació la qual després es pot veure resumida en una taula final també molt visual.

D'altra banda, s'està veient que en el futur les empreses que no analitzin les seves dades i en treguin informació, o sigui, que no facin servir Suites BI, tenen un futur molt incert. És cert, que també hi ha qui diu que el futur és el Big Data però com es pot observar en les explicacions que s'han donat en el seu apartat, BI té molta força i potència i sembla ser que tots dos conviuran perfectament.

En resum, s'han aconseguit els objectius planificats inicialment aportant de forma agrupada la informació dels paquets més importants en BI perquè les empreses els sigui més fàcil decidir una eina de treball d'aquest tipus que els permeti poder competir amb els millors dins del seu mercat.

14. Glossari

A continuació es defineixen els termes i acrònims més rellevants que es poden trobar dins aquest projecte.

Terme	Significat
<i>AGPL</i>	
<i>BI</i>	Business Intelligence
<i>CMI</i>	Cuadro de mando integral
<i>DB</i>	Data Base
<i>DSS</i>	Sistemas de soporte a la decisión
<i>DW</i>	Data Warehouse
<i>ETL</i>	Extraction, Transformatin and Load
<i>ISO</i>	International Organization for Standardization
<i>KGI</i>	Key Goal Indicador
<i>KPI</i>	Key Performance Indicator
<i>LGPL</i>	Licencia Pública General Reducida
<i>OLAP</i>	On-Line application
<i>PMBOK</i>	Project Management Body ok Knowledge
<i>TFG</i>	Treball fi de grau

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16. Annexos

S'adjunta com a annex l'informe Gartner 2017 que es pot trobar de forma gratuïta a la web:

<https://www.gartner.com/doc/reprints?id=1-3TYE0CD&ct=170221&st=sb>

Consulta realitzada el 16/05/2017

Magic Quadrant for Business Intelligence and Analytics Platforms

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Analyst(s):

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Summary

The business intelligence and analytics platform market's shift from IT-led reporting to modern business-led analytics is now mainstream. Data and analytics leaders face countless choices: from traditional BI vendors that have closed feature gaps and innovated, to disrupters continuing to execute.

Strategic Planning Assumptions

By 2020, smart, governed, Hadoop/Spark-, search- and visual-based data discovery capabilities will converge into a single set of next-generation data discovery capabilities as components of modern BI and analytics platforms.

By 2021, the number of users of modern BI and analytics platforms that are differentiated by smart data discovery capabilities will grow at twice the rate of those that are not, and will deliver twice the business value.

By 2020, natural-language generation and artificial intelligence will be a standard feature of 90% of modern BI platforms.

By 2020, 50% of analytic queries will be generated using search, natural-language processing or voice, or will be autogenerated.

By 2020, organizations that offer users access to a curated catalog of internal and external data will realize twice the business value from analytics investments than those that do not.

Through 2020, the number of citizen data scientists will grow five times faster than the number of data scientists.

Market Definition/Description

This document was revised on 3 March 2017. The document you are viewing is the corrected version. For more information, see the [Corrections](#) page on [gartner.com](#).

Visual-based data discovery, a defining feature of the modern business intelligence (BI) platform, began in around 2004 and has since transformed the market and new buying trends away from IT-centric system of record (SOR) reporting to business-centric agile analytics. Modern BI and analytics platforms are characterized by easy-to-use tools that support a full range of analytic workflow capabilities and do not require significant involvement from IT in order to predefine data models upfront as a prerequisite to analysis (including at enterprise-scale deployment).

Gartner redesigned the Magic Quadrant for BI and analytics platforms in 2016, to reflect this more than decade-long shift. A year later, in 2017, there is significant evidence to suggest that the BI and analytics platform market's multiyear transition to modern agile business-led analytics is now mainstream. Reduced feature differentiation among a crowded market of players, buyer requirements for larger enterprise deployments, and the emergence pricing pressure are evidence of the maturity of the current market. For their part, buyers want to expand modern BI usage, including for self-service to everyone in the enterprise and beyond. They want users to analyze a more diverse range and more complex combinations of data sources (beyond the data warehouse or data lake) than ever before — without distinct data preparation tools. Whereas the initial modern BI disruption shifted purchasing from IT to the lines of business — where new tools initially landed as point purchases — as these tools have demonstrated value, enterprise buying of these platforms has grown to the point where the purchasing influence is tipping back to include IT and central purchasing groups. This is further evidence of market mainstreaming and has caused buyers to place greater emphasis on enterprise readiness, governance and price/value, in addition to the agility and ease of use demanded by business users. Land-and-expand buying models are still important to demonstrate value and drive expansion, but mechanisms to economically scale deployments across the enterprise have gained in importance.

The crowded BI and analytics market includes everything from longtime, large technology players to startups backed by enormous amounts of venture capital. What is new this year, is that traditional BI vendors that were slow to adjust to the "modern wave of disruption" (such as IBM, SAP, Oracle and MicroStrategy) and struggled to remain relevant during the market transition, have finally matured their modern offerings enough to appeal to many in their installed bases already using these platforms as the standard for enterprise reporting, and that value their enterprise features and the potential to leverage years of investment in data models and analytic content.

Moreover, as the visual-based exploration paradigm has become mainstream, a new innovation wave is emerging that has the potential to be as disruptive as

(or more than) visual-based data discovery has been to the previous semantic-layer-based development approach of traditional BI and analytics platforms. While the current visual-based data discovery approach has accelerated data harmonization and the visual identification of patterns in data, as opposed to the previous IT-centric semantic-layer-based approach, the tasks for creating insights are still largely manual and prone to bias. Smart data discovery — introduced by IBM Watson Analytics and BeyondCore (acquired by Salesforce as of September 2016) — leverages machine learning to automate the analytics workflow (from preparing and exploring data to sharing insights and explaining findings). Natural-language processing (NLP), natural-language query (NLQ) and natural-language generation (NLG) for text- and voice-based interaction and narration of the most statistically important findings in the user context are key capabilities of smart data discovery. Consistent with the classic innovator's dilemma, many of the traditional BI vendors (such as IBM and SAP, which were innovators of the semantic-layer-based platform) were slow to adjust to the shift to modern BI. However, they have been ahead of the current modern BI disrupters — Tableau, Qlik and TIBCO Spotfire — now facing their own innovator's dilemma regarding investment in the next smart data discovery market wave.

Views on deployment options are also shifting and having an impact on the market. For the past three years, interest in deploying BI and analytics platforms in the cloud had been hovering around 45% of customer reference survey respondents for this Magic Quadrant — with the greatest interest coming from lines of business. In this year's survey, active and planned cloud BI deployments jumped to more than 51%, with much of this shift in interest coming from IT respondents. Most BI and analytics platform vendors are now responding in a significant way: with a range of cloud deployment and subscription pricing model options, and different degrees of support for leveraging the on-premises investments that buyers have already made.

This Magic Quadrant focuses on products that meet the criteria of a modern BI and analytics platform (see "Technology Insight for Modern Business Intelligence and Analytics Platforms"), which are driving the majority of net new mainstream purchases in the market today. Products that do not meet the modern criteria required for inclusion in the Magic Quadrant (because of the upfront requirements for IT to predefine data models, or because they are enterprise-reporting-centric) will be covered in our Market Guide for traditional enterprise reporting platforms (to be published later in 2017). Emerging and next-generation innovative modern BI and analytics platforms that do not yet meet the inclusion criteria for the Magic Quadrant are mentioned in the Appendix to this Magic Quadrant.

Magic Quadrant customer reference survey composite success measures are cited throughout the report. Reference customer survey participants scored vendors on each metric; these are defined in Note 1.

The Five Use Cases and 15 Critical Capabilities of a BI and Analytics Platform

We assess and define 15 product capabilities across five use cases as outlined below.

Vendors are assessed for their support of five main use cases:

- **Agile Centralized BI Provisioning.** Supports an agile IT-enabled workflow, from data to centrally delivered and managed analytic content, using the self-contained data management capabilities of the platform.
- **Decentralized Analytics.** Supports a workflow from data to self-service analytics. Includes analytics for individual business units and users.
- **Governed Data Discovery.** Supports a workflow from data to self-service analytics to SOR, IT-managed content with governance, reusability and promotability of user-generated content to certified SOR data and analytics content.
- **OEM or Embedded BI.** Supports a workflow from data to embedded BI content in a process or application.
- **Extranet Deployment.** Supports a workflow similar to agile centralized BI provisioning for the external customer or, in the public sector, citizen access to analytic content.

Vendors are assessed according to the following 15 critical capabilities. Changes, additions and deletions from last year's critical capabilities are listed in Note 2. Subcriteria for each capability are listed in Note 3, and detailed functionality requirements are included in a published RFP document (see "Toolkit: BI and Analytics Platform RFP"). How well the platforms of our Magic Quadrant vendors support these critical capabilities is explored in greater detail in "Critical Capabilities for Business Intelligence and Analytics Platforms."

Infrastructure

1. **BI Platform Administration, Security and Architecture.** Capabilities that enable platform security, administering users, auditing platform access and utilization, optimizing performance and ensuring high availability and disaster recovery.
2. **Cloud BI.** Platform-as-a-service and analytic-application-as-a-service capabilities for building, deploying and managing analytics and analytic applications in the cloud, based on data both in the cloud and on-premises.
3. **Data Source Connectivity and Ingestion.** Capabilities that allow users to connect to structured and unstructured data contained within various types of storage platforms, both on-premises and in the cloud.

Data Management

4. **Metadata Management.** Tools for enabling users to leverage a common SOR semantic model and metadata. These should provide a robust and centralized way for administrators to search, capture, store, reuse and publish metadata objects such as dimensions, hierarchies, measures, performance metrics/key performance indicators (KPIs), and report layout objects, parameters and so on. Administrators should have the ability to promote a business-user-defined data mashup and metadata to the SOR metadata.

5. **Self-Contained Extraction, Transformation and Loading (ETL) and Data Storage.** Platform capabilities for accessing, integrating, transforming and loading data into a self-contained performance engine, with the ability to index data and manage data loads and refresh scheduling.
6. **Self-Service Data Preparation.** "Drag and drop" user-driven data combination of different sources, and the creation of analytic models such as user-defined measures, sets, groups and hierarchies. Advanced capabilities include machine-learning-enabled semantic autodiscovery, intelligent joins, intelligent profiling, hierarchy generation, data lineage and data blending on varied data sources, including multistructured data.

Analysis and Content Creation

7. **Embedded Advanced Analytics.** Enables users to easily access advanced analytics capabilities that are self-contained within the platform itself or through the import and integration of externally developed models.
8. **Analytic Dashboards.** The ability to create highly interactive dashboards and content with visual exploration and embedded advanced and geospatial analytics to be consumed by others.
9. **Interactive Visual Exploration.** Enables the exploration of data via an array of visualization options that go beyond those of basic pie, bar and line charts to include heat and tree maps, geographic maps, scatter plots and other special-purpose visuals. These tools enable users to analyze and manipulate the data by interacting directly with a visual representation of it to display as percentages, bins and groups.
10. **Smart Data Discovery:** Automatically finds, visualizes and narrates important findings such as correlations, exceptions, clusters, links and predictions in data that are relevant to users without requiring them to build models or write algorithms. Users explore data via visualizations, natural-language-generated narration, search and NLQ technologies.
11. **Mobile Exploration and Authoring.** Enables organizations to develop and deliver content to mobile devices in a publishing and/or interactive mode, and takes advantage of mobile devices' native capabilities, such as touchscreen, camera and location awareness.

Sharing of Findings

12. **Embedding Analytic Content.** Capabilities including a software developer's kit with APIs and support for open standards for creating and modifying analytic content, visualizations and applications, embedding them into a business process and/or an application or portal. These capabilities can reside outside the application, reusing the analytic infrastructure, but must be easily and seamlessly accessible from inside the application without forcing users to switch between systems. The capabilities for integrating BI and analytics with the application architecture will enable users to choose where in the business process the analytics should be embedded.

13. **Publish, Share and Collaborate on Analytic Content.** Capabilities that allow users to publish, deploy and operationalize analytic content through various output types and distribution methods, with support for content search, scheduling and alerts. Enables users to share, discuss and track information, analysis, analytic content and decisions via discussion threads, chat and annotations.

Overall platform capabilities were also assessed:

14. **Platform Capabilities and Workflow.** This capability considers the degree to which capabilities are offered in a single, seamless product or across multiple products with little integration.

15. **Ease of Use and Visual Appeal.** Ease of use to administer and deploy the platform, create content, consume and interact with content, as well as the visual appeal.

Magic Quadrant

Figure 1. Magic Quadrant for Business Intelligence and Analytics Platforms



Source: Gartner (February 2017)

Vendor Strengths and Cautions

Alteryx

Alteryx offers a workflow-based platform for data preparation and building of parameterized analytic applications. The company's origins in location and geoanalytics have proved to be a differentiator, along with its advanced analytic capabilities (discussed in depth in Gartner's Magic Quadrant for data science). Alteryx is widely used in combination with other modern BI and analytic products (particularly Tableau), but also as an end-to-end analytic application

as well as formatted, scheduled reports. With the Alteryx Server, data modelers can create interactive, parameterized dashboards published on-premises or in the cloud via the Analytics Gallery.

Alteryx is positioned at the top of the Niche Players quadrant. Its movement out of the Visionaries quadrant is driven in part by its lack of focus on smart data discovery, limited industry vertical offerings, and being given lower scores by its reference customers on sales strategy (these were dragged down by pricing concerns).

STRENGTHS

- **Self-service data preparation with advanced analytics:** Alteryx scored in the top quartile of all the vendors in this Magic Quadrant for supporting complex types of analysis. It allows power users, such as citizen data scientists, to combine data from multiple and varied data sources, while also transforming and cleansing data, then perform predictive or spatial analytics in the same repeatable workflow. In this regard, Alteryx is ideal when a data lake is part of a logical data warehouse. Alternatively, Alteryx can be used as the agile modeling layer whose output feeds into a visual data discovery tool (such as Tableau, Qlik Sense or Microsoft Power BI). The product provides in-context data browsing to aid in the preparation process. Alteryx's reference customers report among the greatest breadth of usage (of all Magic Quadrant vendors), which includes data integration and predictive analytics. It also has among the highest percentage of its survey customers using the platform for moderately complex analysis.
- **Business benefits:** Alteryx is in the top quartile for achievement of business benefits, for both qualitative factors and the hard benefits of data monetization, improved customer service and decreased IT costs. In terms of decreased IT costs, Alteryx's reference customers cite the ability to rapidly prototype complex data mashups as a way of substantially reducing development times compared with traditional data integration processes.
- **Operations and support:** Customer reference survey scores for vendor operations include an assessment of product support, quality and migration. For product support, Alteryx is ranked second overall; this is arguably made easier by a single product line and less frequent product releases (with one major release, and two to three minor releases, per year) than vendors with multiple products and continuous release cycles. Alteryx's product quality scores also put it in the top quartile.
- **User enablement and skilled resources:** User enablement is important for self-service analytics, where business users become the data preparers and application authors. Traditional classroom training is one aspect of this, but continuous education approaches — such as self-paced tutorials, community forums, and sharing of best practices at user conferences — are also important. Alteryx ranked in the top quartile overall for user enablement, with particularly high customer survey scores for the availability of its skilled resources. However, there is less

satisfaction among its customers with the availability of Alteryx-skilled resources in the broader marketplace.

CAUTIONS

- **"Co-opetition" and lack of front-end visualization capabilities:** A number of Alteryx's partners continue to invest in their own self-service data preparation capabilities, potentially marginalizing Alteryx to just fill its partners' products shortcomings. Conversely, Alteryx's portfolio is most notably lacking in its visual exploration capabilities for business users, with the current charting and exploration capabilities geared to data preparation. Once an analyst builds an application or dashboard, this is more akin to a parameterized report than to free-form exploration.
- **Subscription costs:** Software cost was cited as a barrier to the wider deployment of Alteryx by 51% of its survey customers, a jump from 38% in 2015. Alteryx licenses its software as an annual subscription, starting at \$3,995 for the desktop Alteryx Designer. This is not only higher priced than alternative self-service data preparation products, but also potentially comes on top of the cost of partner products (such as those from Qlik and Tableau) for which customers already cite cost as a barrier to adoption.
- **Deployment size:** Alteryx deployments are small, which can partly be explained by the product being used by a few power users to fill a particular piece of the analytics workflow; cost concerns may be a further inhibitor here. The average deployment size was 83 users, with 57% of reference customers having fewer than 50 users; this puts Alteryx in the bottom quartile of deployment size for this Magic Quadrant. In addition, Alteryx is rarely the only enterprise BI and analytics platform standard (identified as such by just 18% of reference customers); less than one-third of its reference customers say it is one of many standards and 20% cite another product as their enterprise standard.
- **Mixed ease-of-use scores:** Ease of use can be a difficult aspect to assess, because it is somewhat based on a user's experience with other products. Alteryx has benefited from a halo effect when users compare its data preparation capabilities with industrial-strength data integration products and manual efforts to mash up and cleanse data. Initially, the product and its processes seem so much easier by comparison, and this is one reason why surveyed reference customers rank Alteryx the highest of all vendors in this report on ease of content development. However, the business user (who is the ultimate decision maker) is perhaps the most important user, and for content consumers Alteryx ranks in the bottom quartile for ease of use. Lower scores on ease of use are a significant part of the market understanding of its offerings, which further affects Alteryx's position for Completeness of Vision.

Birst

Birst provides a full range of data management and analytic capabilities on multitenant cloud architecture through a software as a service (SaaS)-based delivery model. Birst Enterprise Cloud can be deployed in a public or private

cloud or in a customer's data center; and for organizations that are not willing or able to adopt a cloud-based BI solution, the same underlying product — branded as Birst Enterprise Virtual Appliance — is offered for on-premises deployments.

In 2016, Birst added enhanced functionality for self-service data preparation, the ability to utilize Exasol as a high-performance, in-memory massively parallel processing (MPP) data store, and increased its use of responsive design techniques as part of a "design once, use everywhere" approach to multiple device types.

Birst is positioned in the Niche Players quadrant. It has the capability to displace incumbent BI deployments and compares very well (functionally) against the leading vendors in this year's Magic Quadrant for some use cases. However, beyond its product alone, Birst has not demonstrated enough traction to be considered a direct challenger to this year's market leaders. Further, its smart and advanced analytic capability and vision lack the required direction for it to be positioned in the Visionaries quadrant.

STRENGTHS

- **End-to-end capabilities:** Birst offers compelling functionality — scoring in the top quartile overall from a functional perspective. The Birst platform is strong in the critical capabilities for metadata management, embedded analytic content, BI platform administration, security and architecture, cloud BI, self-contained ETL and data storage, and also in mobile exploration and authoring. The work the company has done in the area of self-service data preparation — in Birst 6 (launched November 2016) — further bolsters its suitability for decentralized and governed data discovery analytic use cases.
- **Networked semantic layer:** Birst's core concept of "Networked BI" is a differentiator. Its ability to connect centralized and decentralized groups via a network of virtual instances that share a common and reusable set of business rules and definitions is attractive to organizations that want to offer self-service in a managed environment. However, despite its evident suitability for governed data discovery use cases, this remains a minority use of the Birst platform (about one quarter of its customers use it in this way), although this may grow. Birst is deployed across a diverse range of use cases, with centralized BI provisioning and embedded BI being the most prevalent (according to its customer survey references). High utilization in these use cases is expected, given Birst's platform strengths.
- **Enterprise standard:** Birst is a credible vendor, viewed as a viable alternative standard. Its reference customers reported that Birst is their only enterprise BI standard in 66% of cases. This is notable (given that none of the Leaders in this Magic Quadrant scores above 45% for this) and underlines Birst's position as a credible alternative. Note, however, that according to the data gathered, Birst is a standard in smaller deployments. References cited an average deployment size of 787 users, which, while an increase over the prior year, falls below this year's market average of 1,182 users.

- **Cloud leadership:** Birst's platform was built for cloud deployment and its origins remain one of its main differentiators in a market where some competitors are scrambling to catch up in the cloud. This focus was evident among responses from Birst's reference customers, where the top three reasons for selecting it were overall total cost of ownership (TCO), cloud deployment, and implementation cost and effort.

CAUTIONS

- **Narrow use for reporting and dashboards:** As in 2016, Birst scored in the bottom quartile for complexity of analysis; this indicates that the platform continues to be widely used to deliver a narrow range of less complex reporting and dashboard content, even though it offers more advanced capabilities such as data preparation and data discovery. This indication is supported by the fact that 69% of Birst's reference customers report using the platform for parameterized reports and dashboards (the highest proportion of all the vendors in this Magic Quadrant).
- **User enablement:** Birst's user-enablement capabilities are patchy. As would be expected from an organization with a cloud focus, its online user community is excellent. However, in other areas (such as training and documentation) the feedback is less positive and Birst customers report that the availability of skilled resources (from the vendor or its partners) to assist in their deployments is an issue.
- **Achievement of business benefits:** There is a disconnect between Birst's stated aim — of placing great emphasis on customer success and quantifiable business value — and the experience of the reference customers surveyed for this research. This could be related to lower scores on user enablement, which is linked to how much value users get out of their BI and analytics platform. Birst was scored "good," but ranked in the bottom quartile for business benefits in aggregate, and was ranked bottom overall in its ability to reduce external IT costs and reduce IT head count when using BI.
- **Used for less complex types of analysis:** Birst's vision is not currently tracking with the overall trend in the BI and analytics platform market — toward increasingly automated and autoinferred approaches to analysis. This is reflected in the fact that embedded advanced analytics, and in particular smart data discovery, are areas of weaknesses in the platform. Birst needs to guard against being left behind as the buying agenda shifts toward these criteria. While Networked BI is a different message, it effectively remains an improved approach to traditional BI use cases rather than a visionary approach to analytics.

Board International

Board delivers a single, integrated system that provides BI, analytics and corporate performance management (CPM) capabilities in a hybrid in-memory self-contained platform. The focus is to deliver a single and unified information platform as a basis for analytics, planning and budgeting, and consolidation. Board is based in Switzerland; its main market is Europe, with subsidiaries in

Europe, North America and Asia/Pacific. It supports clients in South America through its partners. Board's investments in expansion have paid off, with growth across all regions and in particular in the North American market. Board established a new international headquarters in Boston, Massachusetts, U.S., during 4Q16.

Board is positioned as a Niche Player in this Magic Quadrant. It successfully serves the submarket for centralized, single-instance BI, analytics and CPM platforms. Board's narrow focus, but growing regional adoption, together with limited market awareness explains its position for Completeness of Vision. Board is well-positioned in this unified BI/CPM submarket and offers its platform on-premises as well as in the cloud. Board has started to invest in machine-learning automated smart capabilities in order to catch up with the visionaries of the fast emerging next wave — that of smart data discovery platforms.

STRENGTHS

- **Widely deployed unified platform:** Board's single-instance platform, with its proprietary hybrid in-memory capabilities, is mostly used in the agile centralized BI provisioning use case. The average deployment size (in terms of number of users among its survey reference customers) puts it in the top quartile of all the vendors in this Magic Quadrant and shows evidence of Board's success in large enterprises and broader deployments across its midsize client base.
- **Improved business operations:** Board achieved scores that were slightly above average for support and operations (from its reference customers). This is an improvement over last year's survey, where these scores were below average. Migration experience was also slightly above average and sales experience is good, as outlined, with a score that is slightly above average. In this respect, Board is a good company for clients to work with throughout the life cycle of engagement.
- **Customer satisfaction:** Board was in the top third of all the vendors in this Magic Quadrant for client satisfaction, with a very low number of clients indicating that they plan to discontinue their use of its products. In addition, no really significant platform limitations, or limitations to its wider use, were expressed by its customer references. Sales experience was rated slightly above average. Board's clients were able to achieve the business benefits they had expected, as revealed by a slightly above-average score from reference customers.
- **Breadth of use:** Board achieved the top score in terms of breadth of use. Breadth of use looks at the percentage of users that use the product for a range of BI styles — from viewing reports, creating personalized dashboards and doing simple ad hoc analysis, to performing complex queries, data preparation, and using predictive models. This plays to the strength of a unified platform.

CAUTIONS

- **Keeping user enablement in focus:** Board's growth in all regions, in particular outside its European home market, challenges it to find new ways to better enable its users. Customer reference scores in the bottom

quartile indicate room for improvement here. The availability of documentation and online tutorials, an active user community, and the availability of skilled resources are particular aspects that Board should focus on improving in order to sustainably satisfy a growing global customer base. This is also critical to the delivery of business benefits as usage expands. More proficient users tend to use the platform to drive greater business value.

- **Used on smaller datasets:** More than 40% of Board reference customers report that their largest queries are below 1GB, among the lowest of any Magic Quadrant vendor; they also report querying among the lowest number of data sources. Board's core cube architecture based on multidimensional online analytical processing (MOLAP) or relational online analytical processing (ROLAP) can become a limiting factor, especially for clients who need to access and analyze diverse data sources and for clients who wish to perform more complex types of analysis on those diverse data sources.
- **Market understanding:** While the proportion of Board's survey customers selecting the platform for its usability is among the highest of any vendor in this Magic Quadrant, ease of use across all measures (including for administration, content authors, content consumers and for visual appeal) is rated as below average. Moreover, customers use Board for less complex types of analysis and data models and less diverse data sources, which has contributed to its slightly below-average score for complexity of analysis (a component of market understanding). The fact that Board has one of the highest percentages of its survey respondents using the platform for parameterized reports and dashboard, is another indication that the platform tends to be used for simpler analytics (similar to last year).
- **Limited use for cloud and embedded:** Board received lower ratings for its cloud capabilities, with the percentage of its reference customers using or planning to deploy the platform in the cloud (compared with other Magic Quadrant vendors) putting it in the bottom quartile. Similarly, and consistent with its weaker ratings for embedded capabilities, Board's survey customers report among the lowest use of the platform for embedded as well as externally facing use cases.

ClearStory Data

ClearStory Data is a cloud-based BI and analytics platform that allows for smart data integration, data storytelling and collaboration in a single platform. It uses Spark-based processing to handle large data volumes, but that data must be moved to the cloud. ClearStory is well-suited to business users that need to combine, harmonize and explore multiple and varied data sources, including personal, cloud, streaming and syndicated data.

ClearStory Data is once again positioned in the Visionaries quadrant, but further to the right this year. Its far-right placement is largely influenced by its strong market understanding, with high scores for ease of use and complexity of analysis, as well as a product roadmap that includes further enhancements to smart data discovery and crowdsourced analytics. ClearStory Data's Ability to

Execute is limited by its lack of a strong geographic presence, being a smaller vendor in an already crowded market, and limited awareness among potential customers.

STRENGTHS

- **Smart data inference and harmonization:** ClearStory was recently awarded a U.S. patent for its smart data inference and harmonization, which leverages machine learning. Customers choose ClearStory primarily for its data access and integration capabilities. The broad range of data sources, as well as broad usage styles (from data integration and complex queries, to simple ad hoc analysis), contributed to the vendor gaining the highest score of all those in this Magic Quadrant for complexity of analysis. ClearStory can ingest from traditional personal and relational data sources, but can also harmonize these data sources with Hadoop-based and other NoSQL data sources — including Google BigQuery and IBM BigInsights, log files, and streaming data sources. Data is processed using Spark for high levels of query and analytic performance on granular data.
- **Ease of use:** ClearStory Data sets a new standard for ease of use, having achieved the highest customer reference score for ease of implementation and administration, as well as ease of content consumption. Across other ease-of-use drivers — for content creation and visual appeal — ClearStory Data scored in the top quartile. Its data blending capabilities are an example of why this vendor rates so highly for ease of use; most products will help with data mashups by automatically joining other datasets based on the same column name once a secondary set has been selected. ClearStory Data, on the other hand, will profile data based on values in order to do smart matching. In addition, the product will suggest other public and premium datasets that are mashable, a capability it refers to as "Data You May Like."
- **Customer experience:** ClearStory also gained the highest score for customer experience based on the achievement of business benefits, user enablement, and availability of skilled resources from the vendor. As a smaller vendor, it would be expected that the availability of skilled resources in the marketplace would be lower, yet customers reported satisfaction here as well. This result may be based on the general availability of Spark and cloud expertise; or there being no need for such resources; or the "halo effect" in which satisfied customers rate everything as high. The one low area for user enablement is the lack of a user conference, although this is hardly surprising with less than 100 production customers.
- **Industry data sources and templates:** While many startup BI and analytics vendors lack industry vertical solutions, ClearStory has continued to expand its prebuilt templates and the number of industry-specific data sources it understands and can readily ingest. The vendor provides templates for Customer Service Insights, Pipeline and Opportunity Analysis, Ad Intelligence, Trade Promotion and Loyalty Analysis, Media Customer Churn Analysis and Clinical Trial Analysis, to name a few. ClearStory estimates that half its customers begin their

deployment with these templates. The vendor has added more application connectors in 2016, including Zendesk, Jira and Google Analytics.

CAUTIONS

- **Mainly cloud:** ClearStory Data is primarily a cloud BI and analytics solution. It lacks hybrid connectivity for live query of on-premises data sources, although customers can connect to and load on-premises data sources. This may make the product less suitable for customers with large-scale, on-premises data sources that do not want their data in the cloud. In addition, ClearStory Data relies on its own physical data centers; on a case-by-case basis, ClearStory will work with customers who want to deploy in Amazon Web Services (AWS) or on-premises. The data centers have a number of security certifications — such as SOC2, the Federal Information Security Management Act (FISMA) and ISO 2700.
- **Limited funds:** A privately held vendor, ClearStory Data is a smaller vendor in a crowded market. As of December 2016, the vendor had received \$54 million in venture capital funding. Many other BI and analytics startups have continued to receive more funding during the past two years, enabling additional head count and market momentum. While the granting of a patent is important in the company's evolution, the self-service data preparation market continues to expand and become more crowded, making this set of capabilities a more challenging differentiator.
- **Deployment size:** ClearStory Data has some of the smallest deployments of all the vendors in this Magic Quadrant, scoring in the bottom quartile with 85% of reference customers having less than 100 users. While ClearStory had no large-scale deployments in 2015, it did add six customers with more than 500 users during 2016. Only 11% of reference customers say the product is the enterprise standard, while 63% say it's one of several standards supported. The Spark-based processing is positioned to provide greater performance at scale, yet the majority of ClearStory's customers are analyzing less than 1TB of data in the in-memory analytic cache; input data sizes from both Hadoop and relational sources also put it in the bottom quartile. In part, the movement of data to the cloud may be a limiting factor, even though based on customer choice rather than any technical limitation.
- **Geographic presence and awareness:** ClearStory Data only has employees in North America, though it has plans to add local head count in Europe and Asia/Pacific during 2017. ClearStory's product is only available in English, with no localization.

Datameer

Datameer specializes in big data analytics, targeting organizations investing in data lakes and other types of big data environments supporting analytics. The company offers a modern BI and analytics front end with the potential to solve complex problems (leveraging the native query engines for Hadoop and Spark) and with support for an expanding range of connectors to other types of data

(including SQL-based data stores, digital interaction sources and sensor data). As of December 2016, the company has received \$76.7 million in venture capital funding.

For its debut in the BI and analytics Magic Quadrant, Datameer is positioned as a Niche Player. Datameer is well-suited to organizations with complex analytics requirements on big data. Its product strategy is focused on big data analytics. More-limited market awareness and geographic coverage that is highly centered on North America (not uncommon for a new startup), combined with an immature land-and-expand sales strategy (compared to other vendors on this Magic Quadrant) and limited vertical offerings, have contributed to its position on the Completeness of Vision axis. While strong in big data, which is Datameer's "sweet spot," it has gaps in its front-end capabilities and this, together with limited market awareness and a weaker sales, customer and operations experience, has contributed to its position on the Ability to Execute axis.

STRENGTHS

- **Analytics on big data:** Datameer has strong capabilities in self-contained ETL and data storage, and native connectors to big data sources. A patent pending smart execution framework is one of the components supporting those platform back-end strengths. The Datameer platform is capable of identifying the right query processing engine for each analytics task — from Hadoop Tez to Spark, and others — in a way that is transparent to the user. The platform can ingest and process data from multiple sources, but is optimized for big data use cases.
- **Complex data and analytics environments:** The platform is fit for complex types of analysis, with the highest ratings for complexity of analysis of all the vendors in this Magic Quadrant (according to the reference customer responses). It is especially suited to serve the citizen data scientist and data engineer roles. Support for different types of data, from digital marketing sources to Internet of Things (IoT) environments, are also strengths for which Datameer scores in the top quartile of all the vendors in this Magic Quadrant. Customers select Datameer's solution for its ease of use for content authors and developers — for challenging big data use cases, for data access and integration with minimal IT support required — and for its ability to support large amounts of data.
- **Short time to develop content:** Datameer customers report favorable development times for content across different levels of complexity when compared with the averages for this Magic Quadrant. This is particularly impressive given the complexity of the data and analysis done by content authors with Datameer. This ability will appeal to roles such as the citizen data scientist, which need to speed the exploration process and time to insight.
- **Large data source sizes and diverse types of data:** The average size of data sources on Datameer deployments places it in the top quartile of the vendors in this Magic Quadrant. This is, however, an expected result, based on the fact that the platform is usually selected for its ability to

explore big data repositories (on Hadoop-based data lakes, for example). Confirmation of this scalability is provided by the highest percentage of Datameer reference customers reporting (more than 47%) that they have queries of more than 1TB (the highest in this Magic Quadrant). At the same time, only 5% of Datameer's reference customers report poor performance as an issue; this is one of the top results for this Magic Quadrant.

CAUTIONS

- **Capability gaps:** Datameer version 6, which launched in early 2016, improved the platform's front end in several areas and offers good infographics capabilities, but there are still gaps in a number of key capabilities that are expected features of modern BI and analytics platforms. In particular, interactive visual exploration, analytic dashboards, mobile exploration and authoring, publishing, sharing and collaboration are weaker capabilities for Datameer. Moreover, 20% of Datameer's reference customers reported absent or weak functionality to be a platform problem (placing it in the top quartile for this type of issue). To cope with the front-end limitations, it is possible to leverage Datameer's data environment and big data engine using Tableau's interactive visualization capabilities — a capability also extended to Microsoft Power BI more recently.
- **Vendor viability:** Although in a better position this year, versus last, reference customers' perception of Datameer's improved viability still places it in the lowest quartile for this Magic Quadrant. Its lower score for success of the product in the organization, and below-average business benefits, contribute to this result. External factors could also have contributed to this concern as similar products have struggled to gain traction in the market; for example, Platfora (which was acquired by Workday in 2016 before reaching maturity), and Oracle Big Data Discovery (which is too early in its market traction to be considered for this Magic Quadrant). Datameer may be in a better position than these vendors, given its federated support for a range of big data and traditional data sources.
- **Product quality and migration:** Although few customers have reported implementation difficulties — a good result considering the typical complexity of the big data environments where Datameer is deployed — reference scores for both product quality and migration experience put Datameer in the bottom quartile of vendors in this Magic Quadrant. This could be a result of a fast product evolution in the relatively immature and rapidly changing big data space.
- **Small average deployment size:** While data sizes are large for Datameer deployments, user numbers are relatively small. The average deployment size, at 50 users, is near to the lowest for this Magic Quadrant (with 1,182 as the average for all the vendors). Furthermore, customer reference responses confirm that Datameer is not viewed as the enterprise standard for 85% of the organizations that use it (placing it in the bottom quartile). This is not unexpected for a startup.

Domo

Domo is a cloud-based interactive dashboard platform aimed at senior executives and line-of-business users. Domo enables rapid deployment by leveraging its native cloud architecture, an extensive set of data connectors and prebuilt content, and an intuitive, modern user experience. Because Domo is primarily used by business people for management-style dashboards, and is often deployed in lines of business with little or no support from IT, a higher percentage of its customer references report using it primarily for decentralized use cases than is the case for most other vendors in this Magic Quadrant.

During the past year, Domo formalized its channel program and launched developer.domo.com on a newly branded Domo Business Cloud platform and an Appstore for Domo and its ecosystem of partners to sell vetted Domo connectors and apps. Data as a service is on the roadmap, where Domo customers will be able to access, blend and analyze their enterprise data with external open and premium data. Domo also added a limited freemium offering with the option for a fully featured 60-day trial to give users a way to try before they buy and expand their use based on getting business value from the platform — a land-and-expand model supported by most other vendors in the market.

Domo is positioned in the Niche Players quadrant. Its seasoned management team and marketing and sales efforts, funded by a large venture capital reserve, have resulted a high level of awareness. It has been able to expand its customer base and grow deployments in an increasingly crowded and price-sensitive market, with positive execution on a number of measures related to customer experience. Domo's easy-to-use platform has translated into good market understanding; however, its early but expanding geographic presence, and a product vision (with the exception of Domo's app marketplace) that is focused more on closing gaps with current leaders than on innovation, place it just to the right of center in the Niche Players quadrant on the Completeness of Vision axis.

STRENGTHS

- **Rapid deployment of management-style dashboards:** Domo offers an appealing and modern user experience, extensive alerting and workflow, with a range of social and collaboration features — in DomoBuzz — for discussing findings, following alerts, collaboratively developing content, and the user rating of dashboards from the web or mobile devices (including smartphones). These capabilities make it well-suited to rapid deployment of intuitive management-style dashboards. Its native cloud deployment, plus an extensive range of prebuilt connectors to cloud-based data sources and applications, feeds the Domo Apps (both free and premium), which are out-of-the-box content packs with KPIs and dashboards. Although Domo has adoption across all domains, it has most traction in marketing and sales.
- **Ease of use:** Domo is most often selected by its reference customers for its ease of use, data access and integration, and for its implementation effort. Similarly, Domo ranks in the top quartile of the vendors in this Magic Quadrant for its ease-of-use scores. It scores well on market

understanding, because of the positive ease-of-use ratings that outweigh its support for the less complex types of analysis and data models on this metric.

- **Business value:** Reference customers score Domo in the top quartile for achieving business benefits using the platform. Domo's ease of use — combined with what customers report as a "high touch" approach — and its commitment to making them successful as the product matures, contribute to these results. Above-average scores for product quality and migration experience, which is not uncommon for cloud-only platforms, also contribute to its favorable customer perception. Domo customers are also positive about its viability and future, and report greater success with the product this year compared with last year.
- **Growing data and deployment sizes:** Customers report above-average deployment sizes in terms of number of users; dataset sizes analyzed have also increased. With Domo, data is pulled into the Domo Cloud for analysis. Reference customers report that the level of data they are able to query from within the Domo data repository is relatively high (in the top half) compared with the other vendors in this Magic Quadrant. Many reference customers also report selecting and using Domo because it can combine a large number of data sources into business-friendly dashboards; reference customers report that they are able to combine a high (top quartile) average number of data sources compared with the solutions from other vendors in this Magic Quadrant.

CAUTIONS

- **Cloud-centric approach:** Domo's approach requires all data, whether from on-premises sources or cloud applications to reside in its cloud for visualization and analysis, which may not suit organizations with primarily on-premises data sources. Domo has recently introduced an on-premises version (with limited adoption to date) when this is a requirement, and hybrid data connectivity to on-premises data is on the roadmap. Domo offers a desktop tool specifically built for admin users to load on-premises data into its cloud, but this tool is less business friendly than other components of the platform. Also, Domo now supports live customer instances on the following data centers: Amazon US-East, Amazon Australia, Microsoft Azure, and an Equinix colocation. Amazon Ireland is on the roadmap for 2017.
- **Management dashboards with basic interactivity:** While management dashboards are a strength, data discovery features — including business-user-oriented self-service data preparation, analyst-oriented advanced data exploration and manipulation, and embedded advanced analytics — are works in progress compared with the market leaders. This is reflected in Domo's below-average score for complexity of analysis.
- **Cost as limitation to broader deployment:** While reference customers often select Domo for its fast implementation time, they cite cost as a limitation to its broader deployment (at a higher rate than for most other vendors) — despite the potential cost benefits from cloud deployments.

Pricing pressure has become more acute, with more competition and large players introducing dramatically lower cost offerings. This dynamic is likely to increase, because the market has mainstreamed and price/value becomes a more important buying criterion for large-enterprise deployments.

- **Standardization rates and support:** The degree to which Domo's reference customers view Domo as their enterprise BI and analytics platform standard put it in the bottom quartile of the vendors in this Magic Quadrant, which is consistent with its line-of-business focus. User enablement is often the key to widespread adoption. In this regard, Domo is rated below average, particularly for its training, availability of skills in the market and user community, the last of which should improve with Domo's new marketplace investments. Support from Domo is scored relatively low by its reference customers (in the bottom quartile) and customers cite this as one of the biggest limitations to its broader deployment. Support growing pains are not uncommon in a rapidly growing organization such as Domo; however, because support quality is directly related to the customer experience and the ability of users to get value from the platform, if weakness in support becomes chronic it could inhibit growth and satisfaction in the future.

IBM

IBM offers a broad range of BI and analytic capabilities, as represented by the participation of two product offerings in the Magic Quadrant this year: IBM Cognos Analytics and IBM Watson Analytics. Cognos Analytics is version 11 of the Cognos Business Intelligence product line and a much improved and redesigned modern product offering. Watson Analytics continues to pioneer the next-generation, machine-learning-enabled user experience, including automated pattern detection, support for natural-language query and generation and embedded advanced analytics, via a cloud-only solution. IBM's complete analytics portfolio also includes IBM SPSS Predictive Analytics, and IBM Data Science Experience (DSX) which was announced in late 2016 (both covered in the 2017 Magic Quadrant for Data Science Platforms), as well as with IBM Planning Analytics.

During the past year, IBM has delivered on adapting its offerings to more closely align with the market. Cognos Analytics was released in December 2015. The product combines both IT-authored content and content authored by business users within one platform. In addition, several design elements from Watson Analytics have been incorporated, resulting in an easier to use, more visually appealing experience. Cognos Analytics can be deployed both on-premises or as a hosted solution via the IBM Cloud.

IBM remains in the Visionaries quadrant this year. It continues to provide a strong vision, particularly due to innovations around Watson Analytics — although this vision is tempered by offering two distinct products. IBM has generated strong market awareness around both the disruption potential of Watson Analytics' smart data discovery approach and the applicability of Cognos Analytics to help modernize the Cognos installed base. The inclusion of Cognos Analytics, however, marginalizes the market understanding score of

Watson Analytics (by bringing down IBM's overall scores for ease of use and complexity of analysis, which make up this measure). Its position on the Ability to Execute axis is higher than last year, due to an improved sales experience and an improved track record for success within client organizations that are finally considering Cognos Analytics to leverage their long-term Cognos investments, instead of buying competing stand-alone products. A lack of comprehensive product capabilities in both products has kept IBM out of the Leaders quadrant.

STRENGTHS

- **Smart capabilities:** The smart data discovery capabilities introduced by Watson Analytics reflect the next wave of market disruption in the BI and analytics industry. "Smarts" have now been incorporated into both Cognos Analytics and Watson Analytics for automating tasks, exploration and guidance. This results in a faster time to insight for a broader set of users that can now generate the most relevant insights from advanced analytics, without them having specialist data science skills. Machine-learning automation also extends to data preparation tasks such as recognizing time, place and revenue data, analyzing and scoring data quality and natural-language exploration.
- **Vision:** IBM's ability to innovate has been impressive. First demonstrated with the introduction of IBM Watson Analytics, and followed closely by the introduction of Cognos Analytics, IBM has the potential to leapfrog the current visual exploration market to be a major player in next-generation machine-learning-enabled BI and analytics with a user experience in Watson Analytics that is rivaled only by innovative startups. A higher portion of IBM's reference customers chose it for its strong product vision and roadmap than for any other vendor in this Magic Quadrant.
- **Breadth and ease of use:** IBM supports a wide spectrum of analysis and is used by a range of users from business consumers and analysts to citizen and specialist data scientists. The offerings' strong breadth-of-use rating by reference customers puts IBM in the top quartile for this capability. However, breadth of use differs for each product: Cognos Analytics is still primarily being used for parameterized reports and dashboards, while IBM Watson Analytics has broader usage. Reference customers scored IBM in the top third for ease of use, which was also one of the top three reasons why organizations chose to use the platforms — with a higher proportion of Watson Analytics' references choosing this reason than those using Cognos Analytics.
- **Interactions that generate value:** IBM has invested heavily in improving the value customers get out of their interactions with it, and this is starting to pay off. IBM's reference scores put it in the top quartile for both customer and sales experience, and it is considered to be an enterprise standard by the majority of respondents. Use of the platform combined with strong, consistent client/vendor interactions translates into tangible benefits and IBM's reference scores place it in the top quartile for business benefits achieved. Despite being a newer product with a different sales model, Watson Analytics' customers are currently less

satisfied with their experiences than those of Cognos Analytics and scored it as below average.

CAUTIONS

- **Confusing marketing compounded by lack of cohesiveness:** Although IBM has breathed new life into Cognos Analytics, product enhancements are still a work in progress. IBM was relatively late in the market cycle with a viable modern offering for its Cognos installed base, and not combining the products that comprise its modern BI and analytics offering creates confusion for both existing and potential IBM customers. The objective of Cognos Analytics is to provide one tool to address content created by both IT and the business users. Having Watson Analytics as a separate and additional offering — with some similar and extended capabilities — creates issues for those trying to understand how best to leverage the platform. The lack of robust integration and consistency between, and within, the two products further exacerbates these issues.
- **Adoption:** Available since December 2015, Cognos Analytics' adoption has been slow and low, but improving as installed base customers accustomed to long planning cycles to roll out new major releases adapt to the new rapid delivery approach. Average deployment size for Watson Analytics remains low, especially as a percentage of potential users within the organization, and could be attributed to extensive UI changes in 2016 and the modification and omission of some functionality.
- **Support:** IBM's reference customer scores place it in the bottom quartile for overall support. This is the lone area of customer experience that continues to affect IBM's customers, and is inconsistent when compared with the strength of other customer interactions outlined above.
- **Issues with data volume, performance and functionality:** Although IBM users tend to access a relatively high number of data sources (specifically in Cognos Analytics), there are issues with handling required data volumes. IBM rated in the top quartile of all the vendors for the percentage of reference customers citing the inability to access the required volumes of data as a platform problem. Despite IBM's strong breadth of use, there are still gaps in product functionality: Scores for absent or weak functionality ranked in the top third of problems with the platform, suggesting that the modern BI enhancements, particularly in Cognos Analytics, are still a work in progress. While IBM has added an embed and share capability in Cognos Analytics, there are limited software development kits (SDKs) for embedding analytic content. Discrepancies exist between reporting and new analytic dashboards in Cognos Analytics: for publishing and sharing output formats, event-based scheduling and conditional alerts. Real-time collaboration is one example of the gaps in functionality that remain across both platforms.

Information Builders

Information Builders sells multiple components of its integrated WebFOCUS BI and analytics platform (including InfoAssist+, App Studio, Business Intelligence

Portal, Pro Server, Active Technologies, Magnify, Mobile Faves, Performance Management Framework and RStat). For this Magic Quadrant, Gartner has only evaluated InfoAssist+. While Information Builders is known for delivering analytic applications to large numbers of mainstream users in more operational or customer-facing roles (including deployments exceeding 1 million users), InfoAssist+ is positioned for authors who want more than an information consumption experience.

During the past year, Information Builders made significant investments in the self-service data preparation and visual exploration capabilities of InfoAssist+. It has also made major changes in packaging and distribution, and is now leading with InfoAssist+ as the introductory edition to all three editions of the WebFOCUS platform: business user edition, application edition and enterprise edition.

Information Builders is positioned in the Niche Players quadrant. Its ratings in the market understanding, innovation and product vision criteria impacted its Completeness of Vision positioning. The foundation of its modern BI and analytics platform offering — InfoAssist+ — still has little visibility or momentum in the market outside Information Builders' own installed base, which affects its rating for Ability to Execute. Despite changes in packaging and go-to-market strategy, InfoAssist+ is still not being evaluated in many competitive sales cycles.

STRENGTHS

- **Governed data discovery:** InfoAssist+ is a combination of visual data discovery, reporting, rapid dashboard creation, interactive publishing, mobile content and the Hyperstage in-memory engine. Users can create their own analytic content and promote it as InfoApps on the WebFOCUS Server with scalable distribution. If required, InfoAssist+ can also be completely decoupled from the WebFOCUS Server, enabling easier implementation. This combination of IT-centric and modern features demonstrates a strong vision for governed data discovery. This is borne out by Information Builders' reference customers rating InfoAssist+ in the top quartile for the governed data discovery use case.
- **Core functional capabilities:** Consistent with Information Builders' historical strengths, InfoAssist+ has excellent functional ratings in the BI platform administration, security and architecture, mobile exploration and authoring, embedded analytic content, data source connectivity and ingestion, and self-contained ETL and data storage capabilities. As a result of its broad areas of functional strength and use by reference customers, Information Builders' scores place it in the top quartile for breadth of use.
- **User enablement:** Information Builders is a solid, dependable vendor. Its customers have a positive view of its future and very few are considering discontinuing their use of its products. In part, this is due to the strength of its user enablement services. Its customer reference scores place it in the top quartile for user enablement overall, and its user conferences (one element of enablement) were ranked second only to those of Tableau — an impressive result. This vendor was also in the

top quartile for all user enablement categories, with the exception of the availability of skilled resources in the market (where it came in the bottom quartile). This latter result may be surprising given the impressive roster of partners that Information Builders has assembled. However, the majority of its partners are concerned with larger WebFOCUS enterprise deployments, rather than being focused specifically on InfoAssist+.

- **Sales execution and pricing:** This continues to be one of Information Builders' stronger metrics on the Ability to Execute axis. For the most part, customer references gave Information Builders high scores in terms of the flexibility of licensing options and overall experience during the sales cycle. In a crowded market, a high-touch approach to customers remains one of the company's key differentiators.

CAUTIONS

- **Ease of use:** Despite investing in improving its ease-of-use capabilities, customer feedback on this important capability remains considerably below the survey average, being rated in the bottom quartile overall. Customers using InfoAssist+ reported difficulty of use more than for any other product in this Magic Quadrant. Perhaps as a result, both ease of use for business users and ease of use for developers were rated in the top quartile in terms of reasons limiting wider deployment in customer organizations. Accordingly, Information Builders' score for market understanding — a composite rating of ease and complexity of use, and complexity of data, and a contributor to its placement on the Completeness of Vision axis — has weakened compared with 2016 and now places it in the bottom quartile of the vendors in this Magic Quadrant. Information Builders' strong score for complexity of data is offset by its weak scores for complexity of analysis and ease of use.
- **Areas of limited functionality:** Although strong in a number of functional areas, InfoAssist+ has limited functionality in some more modern areas (specifically the cloud BI, self-service data preparation and smart data discovery categories). Cloud is becoming a far more popular deployment model, but InfoAssist+ reference customers are among the least likely to intend adoption of this approach. Information Builders does offer its own cloud hosting, and has also established new partnerships with Microsoft Azure, Amazon Web Services (AWS) and IBM SoftLayer during 2016, better positioning it to take advantage of growing cloud adoption intentions in the future.
- **Lack of momentum:** Based on new customer acquisition, searches and inquiries, Information Builders has not generated an overwhelming amount of interest — especially for a company trying to position InfoAssist+ as a modern BI platform. The InfoAssist+ offering is primarily sold into Information Builders' existing WebFOCUS Server installed base — as part of its traditional information application core business — it is not typically sold stand-alone. Where it is used, InfoAssist+ deployments are small (averaging 166 users in the sample for this Magic Quadrant) and departmental in the main, penetrating just 9% of the total staff of customer organizations (the lowest position overall compared with other vendors in this Magic Quadrant).

- **Slowed innovation:** Information Builders was one of the early innovators of search functionality (as applied to BI), but has been slow to build on this; despite the technical depth of its sister search product Magnify, InfoAssist+ is still primarily a visual data discovery solution. While Information Builders is beginning to develop its products along various available paths — including search-based and smart-based data discovery — this is happening at a slower rate than in the market overall. Key markers on the roadmap include adding the search engine to the platform core, voice-activated query, BI and analytics content narration, and using AI to build self-optimizing apps based on usage; however, none of these was generally available at the cutoff point for this research (1 December 2016).

Logi Analytics

Logi Analytics' BI platform is composed of Logi Info, Vision and DataHub. Logi Analytics is known for its Logi Info product — its ability to embed analytic content in websites and applications, and to enable end-user organizations to extend their BI access externally to customers, partners and suppliers. For this Magic Quadrant, however, Gartner evaluated Logi Suite, the combination of Logi Vision, Logi Info and DataHub. Logi Vision is the company's data discovery tool, which enables business users to prepare, analyze and share data. Logi's DataHub is a data preparation and columnar data store that ingests, blends and enriches data from multiple sources. There is a tight integration between Info and Vision, both of which use DataHub to deliver self-service data preparation.

In 2016, Logi Analytics released version 12.2 of the Logi Suite, delivering enhanced functionality to make self-service data discovery embeddable into analytical applications — for shared authoring of analytics and applications — and expanded data preparation to include more data joining and blending fidelity, as well as faster query performance.

Logi Analytics is positioned in the Niche Players quadrant this year. An increased focus on its long-standing core strength in embedded analytics for IT developers, and its weakness in both marketing strategy and verticalization are reflected in its placement. This should not be seen as an overly negative move, rather, one that reflects how the Logi Suite is used by the majority of its customers. Logi Analytics has an evident specialism in embedding modern BI and analytics within other apps and business processes.

STRENGTHS

- **Solid performer:** According to its reference customers, Logi Analytics provides a high-quality all-round service. Its scores for overall support, product quality and business benefits achieved placed it in the top quartile of vendors for this Magic Quadrant. Reference customers seem untroubled by any of the problems tested for in the survey, and similarly report encountering the common limitations to wider deployment less frequently than average.
- **Cost-effectiveness:** The top two reasons organizations give for selecting Logi are ease of use for developers and an expectation of lighter implementation cost and effort, both of which are indicators of a

lower TCO. This expectation is borne out by its reference customers — when it comes to seeing cost of software as a barrier to wider deployment, Logi's customers are among the least concerned of all. In part, this can also be attributed to its attractive and flexible core-based pricing model.

- **Embedded use-case specialism:** Logi is deployed in an embedded use case by more of its customers than any other vendor covered in this Magic Quadrant. It continues to score highly in the embedded use case from a product perspective. To its credit, Logi has been focusing its marketing efforts on this use case — playing to its functional strengths in a niche where its offering is well-differentiated. In particular, functions such as rapid security integration and real-time database write-back make it very attractive for both OEMs and large-enterprise customers that want to embed modern self-service BI in other apps.
- **Self-service-enabled analytics apps:** In line with its marketing focus, in 2016 Logi improved its self-service capabilities, enabling the use of data discovery embedded within its analytic apps. New capabilities included multilevel crosstab tables and charts; a quick-launch visualizer that smartly understands the data and creates visualizations; and automatic date hierarchy creation, additional visualization forms, and data animations. Logi's capabilities for governed data discovery are also worth evaluating, though little used by its reference customers as yet.

CAUTIONS

- **Simple usage predominates:** Logi's reference customers' scores placed it bottom overall for breadth of use, and in the bottom quartile for complexity of analysis. In other words, Logi tends to get used for less-complex parameterized reporting more often than the Leaders in this market. In line with this (and in part as a result of its usage profile), relatively few Logi customers are employing it for the agile centralized BI provisioning, decentralized analytics, or governed data discovery use cases (for all three of which it is placed in the bottom quartile). After embedded BI, by far the most popular use case for Logi Analytics is in traditional IT-centric reporting, which is not covered by this research.
- **Brand and product recognition:** Logi Analytics remains a little-known name. As the market matures to one where large vendors are once again making their presence felt, brand recognition is of increasing importance because those in the early and late maturity stages of a technology's adoption curve are far more likely to evaluate known names than the market disrupters. In Logi's case, this is exacerbated by some confusion over product naming, even among its customers. The complexity of the Logi Suite, Logi Info, Logi Vision and DataHub naming create some confusion — the company is in the process of simplifying its product labelling. For example, none of its reference customers said they used Logi Vision (its data discovery product), yet they evidently make use of its functionality. Logi's recognition is further limited by its only being directly present in the U.S. and the U.K. and relying on partners elsewhere.

- **No specific cloud offering:** Many buyers now view cloud as a viable alternative deployment option and Gartner data shows an increased tendency toward adoption of BI in the cloud in 2017. Logi has little to offer those buyers directly; its cloud offering is relatively modest, with Logi Info and Logi Vision being available to run within AWS and Microsoft Azure. Logi neither manages nor hosts customer data.
- **Capability gaps:** While Logi Suite has some forecasting features for estimating continuous variables, Logi does not have comprehensive embedded advanced analytics. Also, its smart data discovery functions, which are new in this year's evaluation for the Magic Quadrant, are limited. These gaps may be a factor in how buyers view Logi's offering, as an alternative, in a market where automatically generating forecasting, trends, predictions, clustering, segments, correlations and factor analysis on data load, as well as natural-language query and narration, are readily available.

Microsoft

Microsoft offers a broad range of BI and analytics capabilities with its Power BI suite, delivered via the Azure cloud. Power BI Desktop can be used as a stand-alone, on-premises option for individual users, or when power users are authoring complex data mashups involving on-premises data sources. Power BI offers data preparation, data discovery and interactive dashboards via a single design tool.

(Microsoft Reporting Services and Analysis Services are covered in our Market Guide for traditional enterprise reporting platforms, as on-premises offerings. Excel is frequently used for data analysis, and while it is not considered here as a BI and analytics tool per se, the integration with Power BI has continued to improve.)

Microsoft substantially lowered the price of Power BI in 1Q15 (to \$9.99 per user per month), making it one of the lowest-priced solutions on the market today. Gartner has also seen many customers add Power BI to their Office 365, Microsoft E5 and ELA agreements, further lowering the price and seeding the customer base — regardless of whether or not the product has been deployed.

Microsoft is positioned in the Leaders quadrant again this year, with continued strong uptake of Power BI, accelerated customer interest and adoption, and a clear and visionary product roadmap that includes vertical industry content.

STRENGTHS

- **Cost:** Microsoft is placing downward pricing pressure on the BI and analytics market with both a free desktop product as well as low subscription price per user per month. On an annualized basis, Microsoft Power BI is roughly one-third of the license cost of a three-year perpetual BI license, but 80% lower than other cloud BI products. Low total cost of ownership was cited as the second most important reason for reference customers choosing Microsoft Power BI. However, potential customers should be aware that additional data scale-out options incur additional costs when leveraging Microsoft SQL Azure or HDInsight in the cloud — once they reach the 10GB per user limit in the standard Power BI Pro

price. Being free but functionally deficient does not succeed; this was a problem with the first release of Power BI. However, Microsoft has now narrowed feature gaps and successfully executed on its "five by five" strategy — five seconds to sign up and five minutes to "wow" the customer.

- **Ease of use plus complex analysis:** Microsoft's customer reference scores place it in the top quartile for ease of use and complexity of analysis. Ease of use for content consumers was also the most-cited reason for customers choosing Microsoft Power BI. It was also placed in the top quartile for composite ease of use; however, there is room for improvement in ease of administration and authoring (where the vendor was average). Customers now want ease of use not only with simple queries, but also with increasingly sophisticated types of questions — mashing together multiple data sources from multiple fact tables. Microsoft's ability to manipulate data from multiple data sources — both cloud-based and on-premises, relational as well as Hadoop-based, and including semistructured content — contributed to this high composite score.
- **Vision:** Microsoft is furthest to the right on the Completeness of Vision axis and has also continued to execute on its roadmap with frequent (monthly) product releases. Microsoft was relatively early to introduce search-based queries with Power BI Q&A, and has recently introduced Quick Insights as a basic form of smart data discovery. Microsoft continues to integrate its machine-learning capabilities as part of a complete solution, the Cortana Intelligence Suite. This vendor has also moved a step closer to linking insights to actions, with the recent integration of Power BI with Microsoft Flow and within its business application, Microsoft Dynamics.
- **Active community:** Microsoft has a strong community of partners, resellers and individual users. This community extends the product with prebuilt apps, visualizations and video tutorials, in addition to the content provided directly by Microsoft. This additional content is available via the Microsoft AppSource, further contributing to Microsoft's far-right placement for its Completeness of Vision. Microsoft's reference customer scores placed it in the top quartile for the user-enablement metrics of user community and availability of skilled resources in the marketplace.

CAUTIONS

- **Product immaturity and cloud-only:** The two biggest concerns that Microsoft's reference customers cited relate to absent or weak functionality and an inability to handle required data volumes. While Microsoft has handled some of the tougher product problems (such as hybrid cloud to on-premises connectivity and search), it is missing basic functionality such as the ability to display data in a pivot table or to create subtotals within a tabular display. Microsoft's current work-around is to use Excel to create the pivot table, but this creates a workflow challenge. While Microsoft offers scale-up options, the path is not clear and is further complicated by differing strategies for Analysis Services on-premises versus in the cloud. Data can reside on-premises, but for

sharing and collaboration the dashboards are stored in the Microsoft Azure cloud. An option to publish Power BI reports to on-premises Reporting Services is part of the 2017 roadmap.

- **Breadth of use:** Microsoft's scores from its reference clients place it in the bottom quartile for breadth of use (as with last year). Breadth of use looks at the percentage of users who use the product for a range of BI styles, including viewing reports, creating personalized dashboards and doing simple ad hoc analysis, to performing complex queries, data preparation and using predictive models. Microsoft Power BI is mainly being used for parameterized reports and dashboards.
- **Support:** Microsoft's reference scores placed it in the bottom half of all the vendors in this Magic Quadrant for support quality. While the community is strong, support from Microsoft is not what its customers expect, particularly in terms of response time and time to resolution. Also, 7% of reference customers said that support quality is a barrier to wider deployment, putting Microsoft in the top quartile for this complaint. In part, support challenges can be exacerbated by frequent product releases in which capabilities are changing rapidly.
- **Not the only standard:** Microsoft Power BI is often used in combination with other BI tools, which is not surprising for a newer product to market and one with gaps in functionality. However, this mix-and-match strategy may make it harder for customers who want to minimize their portfolio's complexity. Here, customers may use Power BI as a low-cost option for broadly used, simple dashboards, and then complement it with products from other BI vendors whose products have more robust capabilities. This dynamic may change as Microsoft continues to improve its product capabilities with monthly releases.

MicroStrategy

MicroStrategy Version 10 (released in 2015) combines self-service data preparation, visual data discovery and big data exploration with enterprise BI.

Version 10, a major release for MicroStrategy, added near-functional parity for interactive visual exploration with market-leading platforms to its already best-in-class enterprise reporting capabilities. This combined with MicroStrategy's enterprise features delivered in a single platform make it better-suited to large-scale SOR reporting and governed data discovery deployments for large complex datasets, than most other offerings.

Point releases during the past year have introduced a new dossier client and "workstation" to simplify the creation, sharing and viewing of analytic dossiers and briefing books. Workstation capabilities also streamline the configuration and administration of enterprise deployments, including dynamic scaling of MicroStrategy Cloud in AWS. The new workstation is built on new REST APIs to make the platform more attractive for embedded and OEM use cases.

MicroStrategy is positioned in the Visionaries quadrant, because of its differentiated product strategy around enterprise-grade governed data discovery — including the ability to certify datasets and generate recommendations, based on user behavior and interest, from large and complex datasets.

However, while there are signs of improvement, MicroStrategy's limited market momentum (despite a strong product) and weak customer and operations experience scores from reference customers keep it out of the Leaders quadrant.

STRENGTHS

- **Fully featured integrated product for all use cases:** MicroStrategy has among the highest product ratings of any vendor in this Magic Quadrant, both overall and for all the evaluated use cases. Outstanding scores (the highest product rating) for BI administration, architecture and security, connectivity and mobile platform workflow integration anchor this rating. For mobile BI in particular, MicroStrategy has been an early innovator, with some of the most comprehensive, highly rated and widely adopted capabilities.
- **Readiness for agile enterprise deployments:** MicroStrategy 10 has a seamless workflow for promoting business-user-generated data models and content to enterprise sources while leveraging enterprise features to enable large-scale trusted self-service. Advanced data manipulation, enterprise-grade security (including geofencing through Usher free of charge), native Hadoop access and in-memory columnar data store (PRIME) give business users a gold-standard-like data exploration experience for very large and complex datasets and models.
- **Large deployments with high standardization rates:** MicroStrategy has the largest average deployment size of any vendor in this Magic Quadrant (almost four times the survey average with a percentage that puts it in the top quartile), with more than 55% of its reference customers using the platform as the enterprise standard and another 34% saying that MicroStrategy is one of their standards.
- **Free desktop a compelling add-on:** MicroStrategy has historically focused primarily on enterprise sales to IT buyers. This has made it difficult to generate awareness and attract new business customers — who now (predominantly) buy new products after having first tried them and then expand use virally based on success. In 3Q16, MicroStrategy made its Visual Insight desktop offering for both Windows and Mac available free — a first step toward enabling land-and-expand buying. For existing MicroStrategy customers, the new data discovery functionality in Version 10, combined with an attractive incremental license cost, makes it a compelling alternative to augmenting their BI portfolio with competing products.

CAUTIONS

- **Gaps in collaboration, cloud and smart data discovery:** MicroStrategy is rated highly across most of Gartner's critical capabilities for this market; however, smart data discovery, collaboration and some elements of cloud provisioning score lower. Smart data discovery features such as automated insight generation or integrated NLG are lacking in the current product — although recommendations based on user context, interest and usage are on the roadmap.

MicroStrategy's single-tenant cloud solution lacks packaged domain and vertical content, and a robust content marketplace for customers and partners. Although MicroStrategy was early to invest in the cloud, it also has among the highest percentage of its reference customers reporting that they have no plans to consider deploying it in the cloud.

- **Ease of use:** Although an ongoing area of focus for MicroStrategy development, customers still rate its platform as more difficult to administer (although administration is highly rated in terms of functionality) and consider it less visually appealing than many competing products. Similar feedback is reflected in Gartner's Peer Insights ratings and in inquiries. For both ease of use and visual appeal, MicroStrategy's reference scores place it in the bottom quartile of vendors in this Magic Quadrant. While desktop deployment is relatively easy to download and use, an enterprise deployment still requires significant IT involvement.
- **Limited traction beyond the installed base:** MicroStrategy Version 10 is beginning to gain traction in the MicroStrategy installed base as a viable, often lower cost and integrated alternative to its competitors for the agile self-service and content authoring capabilities. Despite having a strong product, Gartner sees MicroStrategy on new buyer shortlists at markedly lower rates than the Leaders in this Magic Quadrant. Awareness of the product and its differentiators is limited with new buyers. Moreover, sales experience continues to be rated as below average and sales growth and momentum have been modest, although there are indications of improvement.
- **Customer experience and operations:** MicroStrategy scores in the bottom quartile of the vendors in this Magic Quadrant for both customer experience and operations (indeed, on all key measures that make up these composite scores). Below-average scores for support (with response time improved slightly from last year), product quality and ease of migration reveal the concern of its reference customers. The key elements of user enablement are also a work in progress for MicroStrategy. While MicroStrategy has added a user community, and its conferences are rated as slightly above average, detailed scores for training, online tutorials and documentation (which get updated every few weeks) are bringing down the overall average.

Oracle

Oracle offers a broad range of BI and analytic capabilities, both on-premises and in the Oracle cloud. Oracle Data Visualization (ODV), Oracle's modern BI offering, is available as part of the Oracle Business Intelligence Cloud Service (BICS) as a stand-alone cloud service, a desktop offering or as an optional component to Oracle Business Intelligence 12c deployed on-premises. Oracle Big Data Discovery (introduced in February 2015) is a Hadoop-based data exploration and data science platform that is too early in terms of market traction to be assessed. ODV (the focus of this Magic Quadrant) offers integrated data preparation, data discovery (with advanced exploration) and interactive dashboards via a single design tool supporting both desktop and

web-based authoring. It can be deployed in the cloud, on-premises or in hybrid mode (both data and deployment) for a range of analytics use cases — from decentralized to governed and centralized deployments.

Oracle has made it back onto the Magic Quadrant this year because its modern BI and analytics components continue to gain market traction and have functionally matured. Oracle is positioned in the Niche Players quadrant, with an improved product and customer experience and some visionary elements planned on the product roadmap. While Oracle was late to respond to the shift in the market toward modern BI and analytics, it is now starting to appeal to the market — particularly in its own installed base — and is investing early in machine learning-enabled smart data discovery, including automated pattern detection and integrated search/NLP.

STRENGTHS

- **Full spectrum of capabilities:** ODV's narrowing feature gap (compared with its competitors), combined with its integrated end-to-end hybrid cloud approach, appeals to IT departments that have implemented Oracle's traditional BI platform capabilities and to lines of business that have deployed Oracle BI SaaS operational reporting on top of Oracle enterprise applications, particularly given its domain-specific content packs. Users are also able to conduct "what if" and scenario analysis within BICS or ODV Cloud Service via Oracle's Essbase Service. As a result, Oracle's reference customers score it among the highest for breadth of use.
- **Global and hybrid cloud offerings:** Oracle BI can be deployed on-premises or in its global cloud, with the ability to directly query on-premises data from the cloud or migrate and extend on-premises data models and content to the cloud (and vice versa). Oracle's support for hybrid cloud deployments and data has given its on-premises BI customers a glide path to transition to the cloud. More than 54% of Oracle 12c's on-premises reference customers are either deploying or planning to deploy Oracle BI in the cloud — significantly higher than the 45% for IT-centric role respondents in the Magic Quadrant overall.
- **Visual appeal and support for complex analysis:** Reference customers rate the visual appeal of ODV's integrated design experience for reports and dashboards in the top third of all the vendors in this Magic Quadrant, although overall ease of use scores at the survey average. In addition to offering core visual exploration features for light analysis, ODV supports advanced exploration — including custom groups, and drag-and-drop advanced analytic functions such as forecasting, clustering, trending, outliers, and so on. Oracle BI's historical strengths in function shipping queries to the underlying database contribute to its slightly above-average data complexity ratings. Moreover, Oracle's reference customers combine the highest number of data sources in support of their analyses (of any Magic Quadrant vendor).
- **Improved customer experience:** Customers are beginning to report positive results from an increase in emphasis (by Oracle) on product quality and a more streamlined, easier migration/upgrade experience.

While its reference scores for support put Oracle in the bottom quartile, it is placed in the top quartile for migration experience and is above average for product quality — with one of the highest percentages of references reporting no platform problems (of any vendor in this Magic Quadrant) as a limitation to its broader deployment. The new addition of global customer success managers for the cloud is another positive step toward helping customers expand use and standardization rates.

CAUTIONS

- **Pricing and sales experience:** Oracle's challenge to expand beyond early adoption is further hindered by its customers' view of a complex portfolio of multiple product offerings, higher-end pricing and a rating in the bottom quartile for sales experience. Overall for Oracle, the sentiment of Gartner inquiries around buying and negotiating with Oracle is negative, with an above-average percentage of Oracle's reference customers (one in five of the respondents) citing cost as a limitation to broader deployment. Oracle has a new land-and-expand sales approach to line-of-business people, which is the dominant adoption model for most modern BI purchasing. However, while Oracle's list price of \$1,250 for ODV on-premises or \$75 per user per month or core-based pricing for the ODV Cloud Service, is in line with some competitors' list prices for content authors, it is higher than that of many of its competitors for content consumer roles in a market of downward pricing pressure.
- **Immature user enablement:** User-enablement programs are critical for organizations to expand their adoption and derive maximum business benefit from modern BI investments. Although an instant "click to chat" help feature was recently added, user enablement for ODV is a work in process — with scores for user communities and documentation putting it in the bottom quartile, and more limited help within the product than from many other vendors in the Magic Quadrant. Reference customer scores also put Oracle in the bottom quartile for availability of skills from the vendor.
- **Appeal is mostly in the Oracle installed base:** Oracle optimizations — such as smart connectors that inherit Oracle security, content packs for Oracle enterprise applications, and semantic layer access to Oracle 12c and Oracle BI SaaS — make Oracle ODV attractive to its installed base of customers. Oracle's modern BI capabilities are primarily deployed in organizations that also use Oracle's enterprise applications and data management technology. Oracle has the highest percentage (of any vendor in this Magic Quadrant) of its reference customers (at 45%, more than double the next-highest vendor) having standardized on Oracle enterprise applications. Likewise, 64% of its customers have standardized on Oracle as their primary enterprise data warehouse — slightly less than double the next-highest vendor. Oracle is investing to generate net new customers outside of its installed base.
- **Product differentiation:** While ODV has closed many feature gaps with stand-alone competitive offerings, is well integrated with Oracle's traditional BI platform capabilities, applications and data management

products, and has some visionary features on the roadmap, it remains a "me too" offering without significant product differentiation.

Pentaho

Pentaho is a Hitachi Group company. The Pentaho platform offers a range of functionality across data preparation, self-service and advanced analytics, with a particular focus on big data access and integration. Mature data access and data transformation capabilities are provided by Pentaho Data Integration (PDI), and advanced analytic capabilities by its Data Science Pack. While Pentaho can be used for a broad range of BI use cases, it has a strong presence in the OEM and embedded BI market.

In late 2016, Pentaho released version 7.0, which combined its data integration and business analytics servers to support an integrated analytic workflow, added visual data access and preparation, and enhanced its capabilities for accessing diverse data sources with improved governance to solve large-scale and complex analytic use cases.

Pentaho is positioned in the Niche Players quadrant this year. Its relative lack of vision around cloud BI and a range of next-generation machine-learning automation capabilities for smart data discovery including autoinsight generation and natural-language query and generation, as well as weaker customer and analyst views of the ease of use of the platform, have affected its evaluation in the heavily weighted product strategy and market understanding categories (for this year's Magic Quadrant) and have therefore influenced its position on the Completeness of Vision axis. Pentaho's marketing strategy is to focus on big data analytics and the IoT with the Hitachi Insight organization; utilization is frequently for OEM and embedded analytics use cases. Its position on the Ability to Execute axis reflects its relative scores across all measures compared with other vendors in the Magic Quadrant. In particular, current product capabilities, market responsiveness and track record, and vendor viability are slightly below average; it also gained weaker scores for sales experience, customer experience and operations — derived from both customer reference survey data and Gartner inquiries.

STRENGTHS

- **Scope for complexity and scale:** The Pentaho platform's capabilities are broad, spanning from data integration with PDI to advanced analytics with Weka and R integration. Pentaho scores in the top third of vendors in this Magic Quadrant for complexity of analysis undertaken. This aligns with the company's focus on big data and IoT deployments, favoring specialized and advanced implementations. In addition, Pentaho's customer reference scores put it in the top quartile for scale of user deployments, reflecting its use — often by OEM customers — for embedded BI use cases.
- **Data reach beyond traditional sources:** Pentaho is able to blend and analyze traditional SQL-based repositories, ad hoc files, NoSQL databases and unstructured data (such as social media feeds, log data and machine data streams from IoT sources). The top two reasons reference customers cite for selecting Pentaho remain data access and

integration, and license cost (derived from the company's open-source BI platform background). For big data, while most other vendors covered take the easy route of accessing Hadoop through Hive (an Apache SQL compatibility layer), Pentaho offers native integration with technologies such as Hadoop, Spark, Cassandra and MongoDB.

- **Core data-centric functional capabilities:** From a functional completeness perspective, Pentaho's capabilities in the areas of administration, security and architecture, self-contained ETL and data storage, embedded advanced analytics, embedded analytic content, data source connectivity and ingestion and metadata management are all rated as excellent or better. Its capabilities in self-service data preparation, interactive visual exploration, analytic dashboards, and mobile exploration and authoring are less strong, but still rated as good.
- **Embedded analytics:** The OEM and embedded use case is the most frequently employed for Pentaho (where its score puts it in the top quartile). Some of Pentaho's embedded use cases started as open-source enterprise reporting customers that later evolved into a commercial solution. The company's open-source enterprise reporting heritage provides it with a wide network of system integrators and a global geographic presence.

CAUTIONS

- **Customer experience:** Pentaho faces an ongoing challenge in the area of customer experience. Its customer references scored it in the bottom quartile in this area. To be specific, Pentaho's ratings on measures of user enablement (conferences, user community, and availability of skills from the market and the vendor) and business benefits achieved were weaker compared with other vendors in this Magic Quadrant. With additional investment received from Hitachi last year, Pentaho is focusing on improving customer care and developing user-enablement assets. Pentaho needs to allocate some of the resources it now has available (as part of Hitachi Data Systems) to addressing these issues.
- **Market awareness in a crowded market:** Based on volume of searches, analyst inquiries and new customer acquisition, awareness of Pentaho is less than for the market leaders in this space. Although its focus on big data deployments is well-targeted, and different from other vendors, the use of modern BI and analytics platforms on top of big data sources is still emerging and not yet fully mainstream or mature. While a focus is useful, the corollary is that Pentaho's marketing perception and adoption for other use cases may affect its ability to compete in evaluations outside of big-data-specific use cases.
- **Ease of use:** Pentaho's reference customers report that ease of use — a top buying criterion in the modern BI market — is a concern. The Pentaho platform was scored in the bottom quartile for ease of administration, content development and visual appeal when compared to others in the Magic Quadrant. When asked what problems they had encountered, Pentaho reference customers were in the top quartile in naming difficulty in both implementation and usage. This could in part be

a reflection of the big data use cases, and the complex data integration and blending and governance challenges that Pentaho addresses. Perhaps as a consequence, Pentaho's reference customers were also the most likely to report issues with ease of use for developers as a limitation to wider deployment. Pentaho reference customers indicated that they had encountered poor performance (31%), perhaps because of larger data volumes. Weaker ease of use and poor performance both inhibit adoption, and may explain why more than 20% of the reference customers surveyed indicated that their organization is planning to, or may, discontinue its use of Pentaho.

- **Functional gaps:** While strong in the core capabilities of a BI platform, Pentaho is less capable in other areas, with lower scores for critical capabilities in cloud BI and in the business-user-centric categories. These include support for publishing, sharing and collaborating, smart data discovery (where it lacks the ability to automatically generate insights) and natural-language query and generation functionality.

Pyramid Analytics

Pyramid Analytics offers a modern BI and analytics platform with a broad and balanced range of analytics capabilities, including ad hoc analysis, interactive visualization, analytic dashboards, mobile, collaboration, automated distribution and alerts. The solution is well-suited to governed data discovery through features such as BI content watermarking, reusability and sharing of datasets, metadata management and data lineage. As of December 2016, the company has received \$41.5 million of venture capital funding.

Continuing a long-term partnership, Pyramid Analytics remains highly integrated with Microsoft's BI offerings. The platform offers an enterprise analytics front end to Microsoft SQL Server Analysis Services (SSAS), while Microsoft Power BI can publish to the Pyramid BI Office server in order to deliver Power BI content on-premises. The year 2017 may represent a critical period for the company, with Microsoft potentially offering a fully featured on-premises solution for Power BI. Pyramid Analytics will need to demonstrate superior product roadmap development and sales execution in order to be recognized as a viable competitor outside its partner ecosystem and customer base, or as a preferable alternative to Microsoft when competing against it. This represents both an opportunity to sell to the Microsoft customer base and the risk of being sidelined by Microsoft's own offerings if customers begin deploying Power BI fully on-premises.

Pyramid Analytics continues to be positioned in the Niche Players quadrant, demonstrating some challenges to differentiate itself or innovate in a crowded market, particularly in co-opetition with Microsoft — which is rapidly improving its low-cost offering. Pyramid's product roadmap is more focused on rearchitecting the platform to expand beyond its Microsoft roots — in order to also support other platforms — than on developing visionary features. Customers report some weaknesses in market understanding, business benefits, the success of the product in the organization, and customer experience — which affected Pyramid's position on the Ability to Execute axis.

STRENGTHS

- **Solid and broad range of highly integrated capabilities:** Pyramid Analytics offers a solid range of functionality across the spectrum of capabilities expected from a modern platform. Interactive visualization, data source connectivity, and the ability to publish, share and collaborate, can be highlighted as good examples, but the functionality extends well beyond that. Only 9% of Pyramid's reference customers cited absent or weak functionality as a problem with the platform, an above-average result (compared with the other Magic Quadrant vendors). Although not specializing in one particular area, the capabilities of Pyramid's solution are well-implemented, tightly integrated and are surfaced through a user interface that appeals to Microsoft Office users (because of its similar interface).
- **Well-suited to a range of use cases:** The solution offers a good balance between user-driven self-service analytics capabilities and centralized system administration. Governed data discovery continues to be a use case where Pyramid scores in the top quartile, according to its customer references. Traditional IT-centric reporting and extranet deployment are two other use cases where Pyramid Analytics also has high scores; however, customers also report above-average use of the platform for agile centralized and decentralized use cases. Pyramid therefore emerges as a balanced platform fit for multiple purposes.
- **Rapid development times:** With an ease of use that is considered only average, Pyramid is still able to offer quick content development on all categories (simple, moderate and complex content). Reported development times are below the averages for this Magic Quadrant, including being quicker than some of the platforms that are rated more highly on ease of use for content development.
- **Good integration with Microsoft's environment:** Pyramid Analytics has the highest percentage of deployments on top of Microsoft-based enterprise data warehouses (EDWs), at 74% of its customer references. This is even higher than Microsoft's own result or the implementation of Oracle's BI tools on top of an Oracle-based EDW. It is also one of the top platforms used with Microsoft's ERP and CRM solutions. Pyramid does offer a tight and extensive integration with the Microsoft environment and should therefore be assessed when that is a top requirement, although the stated roadmap is to make Pyramid platform-agnostic and available to any enterprise data warehouse.

CAUTIONS

- **Reliance on Microsoft:** Pyramid Analytics' platform offers a balanced set of capabilities, but lacks clear areas of differentiation compared with the market leaders. Currently, Pyramid's "unique capability" and differentiation comes from its integration with Microsoft — an advantage that is turning into a threat to the company. Pyramid Analytics' roadmap announcements for 2017 are intended to leverage an expanded set of data management infrastructures in addition to the Microsoft investments that they already have.

- **Business impact:** Reference customers report a number of issues that signal the low impact Pyramid has on its customers. Its scores for overall user enablement, complexity of analysis, success of product in the organization and customer experience all place it in the bottom quartile for this Magic Quadrant. Delivery of business benefits is also below average. The platform may not be delivering the expected value to customers, which is a concern and particularly so for smaller vendors competing to expand market awareness and use.
- **Market awareness:** Pyramid Analytics is generally not known outside Microsoft-centric organizations. Despite its high-profile partnership with Microsoft for Power BI, during thousands of Gartner's interactions with customers focused on BI and analytics platforms or vendors, customers seldom bring up Pyramid in the conversation or consider the company to be a viable option on their shortlists. Geographic expansion is also an ongoing process. Pyramid Analytics will need to continue the uphill battle of gaining awareness in the market to expand beyond its current (Microsoft-centric) target segment. This will be a concern for some customers, who may struggle to justify their selection of the platform.
- **Future viability:** Reference customers report concerns about Pyramid's viability, positioning the company on the lowest quartile for that question. This situation may be driven by the expanding Microsoft's presence in the market with a solid product; however, below-average product quality, the issues referenced above about lack of impact, and the overall lack of a distinctive product roadmap may be adding to the perception.

Qlik

Qlik offers governed data discovery and analytics either as a stand-alone application or (increasingly) embedded in other applications. Qlik Sense is the vendor's lead product, while QlikView continues to be enhanced and makes up a larger portion of the company's installed customer base.

The in-memory engine and associative analytics allow customers to build robust, interactive applications and to visualize patterns in data in ways that are not readily achievable with straight SQL. NPrinting, which provides report scheduling and distribution, was added to Qlik Sense in 2016 (previously only available for QlikView), enabling Qlik to provide interactive visual discovery and also Mode 1 BI in an agile way.

Qlik is positioned in the Leaders quadrant, driven by a robust product, an above-average customer experience and a strong global partner network. However, its market execution relative to other Leaders has been tempered by challenges in supporting both the established QlikView and the less mature Qlik Sense. Also, the company was taken private by Thoma Bravo in September 2016. While this change has had no material impact on the product roadmap thus far, customers will be watching for consistent and continued commitment to the vendor's longer-term roadmap. Qlik's vision components — a marketplace, smarter data preparation, and leaving data in place for intelligent push-down processing — are important differentiators; however, the vendor lags behind in its investment in smart data discovery (which Gartner believes poses the next wave of disruption) and its competitors are further along.

STRENGTHS

- **Momentum:** Qlik's customer reference scores place it in the top quartile (of all the vendors in this Magic Quadrant) for its market responsiveness, based on a combination of how successfully the product is deployed in organizations and its strong momentum. Qlik's revenue grew 20% for the first half of 2016 (financial numbers are no longer available following Qlik's privatization). Qlik was also placed in the top quartile for interest, based on searches on gartner.com and customer inquiries. With the incorporation of NPrinting into Qlik Sense, Qlik supports both Mode 1 (traditional BI capabilities to schedule reports) and Mode 2 (agile, governed data discovery and visual exploration); this breadth of product capabilities further contributes to its position in the Leaders quadrant.
- **Rapid deployment:** Qlik's scalable, in-memory engine allows lines of business as well as central IT to rapidly mash data from multiple data sources that is then accessible via highly interactive dashboards. Qlik's ease of use for consumers and its visually appealing dashboards have proven to be product differentiators.
- **User enablement:** User enablement is once again a strength for Qlik. With a modern BI architecture, business power users may become the predominant content developers, instead of IT developers. Newer types of training — in the form of online tutorials and community forums — become more important than traditional classroom-style training. Qlik's customer reference scores placed it in the top quartile for these more self-paced forms of training.
- **Partner network:** Qlik's partner network continues to be a differentiator through which partners offer not only product extensions and complementary capabilities, but also professional services. Qlik reference customers score the availability of skilled resources in the market in the top quartile. This partner network has also provided a way for Qlik to expand its capabilities through acquisition, most recently with partner Industrial CodeBox — whose capabilities have improved Qlik's out-of-the box data source connectivity options. In January 2017, Qlik also completed the acquisition of partner Idevio in order to bolster its mapping and location intelligence capabilities.

CAUTIONS

- **More narrow use case:** Complexity of analysis is an important part of a vendor's Completeness of Vision in this Magic Quadrant. While Qlik supports a range of data sources and data models, its reference customers are not using the product in this way. A lower portion of Qlik's references are using it for data integration or visual discovery than in previous years, with a much higher percentage of customers using it for parameterized reports and dashboards. This more narrow use case has affected its position on the Completeness of Vision axis. Bearing this in mind, Qlik's sweet spot may increasingly be for agile, centralized BI provisioning, rather than for more sophisticated analytics use cases as it is deployed more broadly in the enterprise. This may be a reflection of how competitors have evolved in terms of easier data preparation, in

contrast to Qlik — in which a load script is still required for more complex data models and data preparation. Also, advanced analytics capabilities are largely lacking in Qlik Sense, both in the form of R integration as well as out-of-the-box visualizations and menu options, although these items are on the roadmap.

- **Software licensing and cost:** Cost of software was (again) cited as a barrier to adoption by 30% of Qlik's reference customers, putting it in the top quartile for this complaint (similar to 2016). Qlik Sense primarily uses token-based pricing, which more closely aligns to a named user than concurrent user licensing; in theory, tokens can be shared by multiple users to provide a degree of sharing, but with a reset frequency that appears to make license management a challenge. As QlikView customers adopt Qlik Sense, this token approach is proving less flexible and more expensive than the myriad packaging options offered to QlikView customers (which offered session, document, and named user options). More recently, Gartner has begun to see CPU core pricing and enterprise agreements for larger deployments that show more flexibility. Beyond pricing, there were no major barriers to wider adoption, or platform problems; this shows an improvement in product maturity over the previous year.
- **Technical support lags:** Customer references scored Qlik's technical support as slightly below average (compared with other Magic Quadrant vendors) for level of expertise, response time and time to resolution (similar to the responses in 2015). There is a high bar in the modern BI and analytics space, as demonstrated by the fact that despite 66% rating the support as excellent, and only 5% as poor, the vendor was still slightly below average. These scores are part of the reason why Qlik is positioned lower in the Leaders quadrant.
- **Evolving cloud strategy:** Qlik's cloud strategy continued to evolve in 2016, most recently with the addition of Qlik Cloud for Business, which is positioned for small to midsize organizations and limited to 500GB per workgroup. Prior to this release, Qlik customers could deploy QlikView or Qlik Sense in the cloud in a bring-your-own license model. A Qlik Sense Cloud for enterprise customers, with more fine-grained control and unlimited data storage, is planned for 2017.

Salesforce

Salesforce Wave Analytics (Wave) offers standard point-and-click interactive visualizations, dashboards and analysis with integrated self-service data preparation. Wave is sold as a stand-alone platform and also as the foundation of packaged, closed-loop front-office analytic applications for sales, marketing and service. Sold globally, the platform is natively mobile and offers collaboration through integration with Salesforce Chatter. During the past two years, Salesforce has acquired a number of AI-centric companies with the goal of integrating them to build new AI-enabled customer-facing services and applications — branded Einstein — including those analytic applications based on Wave to automatically serve up insights and optimized actions to users in their application context. Salesforce's acquisition of smart data discovery startup

BeyondCore in September 2016 is the most relevant of these acquisitions to this Magic Quadrant and is included in the evaluation and position of Salesforce this year (BeyondCore was positioned as a Visionary on last year's Magic Quadrant). BeyondCore, now rebranded as Salesforce Analytics Cloud Smart Data Discovery (BeyondCore) automatically finds, visualizes and narrates important findings, or the story, in the data that are relevant to each user, without requiring them to build models or write algorithms. The user explores data via visualizations and natural-language-generated narration.

Salesforce plans to continue to sell Analytics Cloud Smart Data Discovery (BeyondCore) as a stand-alone product, marketing it extensively (beginning in 2017) to the Salesforce installed base and beyond. Salesforce has also begun integrating BeyondCore into Wave and Wave-based apps — as separate Einstein-branded apps. Ultimately, the plan is for BeyondCore's automated insight and narrative generation to be a seamless part of the Einstein-enabled Wave platform, applications and experience.

The combination of BeyondCore's disruptive product, together with Salesforce's vision for the combined offering, global presence, partner network, strong positioning and marketing and sales execution potential, places the combined Salesforce/BeyondCore set of capabilities in the Visionaries quadrant. Salesforce continues to initially cater to its installed base, but executing on its next-generation, machine-learning-enabled roadmap could make it a more significant player in the market overall during the next year and beyond.

STRENGTHS

- **Well-positioned for the next BI and analytics wave:** The acquisition and integration of BeyondCore (Analytics Cloud Smart Data Discovery) with the Salesforce Wave Analytics platform and apps has the potential to automatically serve up the most relevant machine-learning-based insights to users in their context through narratives. The algorithms and underlying R code that BeyondCore uses to render results is open for data scientists to validate findings and to export and extend the model.
- **Optimized for Salesforce:** Reference customers rate Wave's dashboard experience as visually appealing and easy to use for Salesforce business consumers to gain integrated, contextualized insights from within the Salesforce Application workflow (particularly when using the packaged Wave-based analytics apps for Sales, Service and Marketing). Data from Salesforce can be combined with non-Salesforce cloud and on-premises data — using Salesforce's new Data Designer self-service data preparation capabilities, as well as data integration partners, to load and model non-Salesforce data into the cloud (rather than accessing it in place). Wave is natively integrated with Salesforce security, collaboration and metadata, including simplified access to Salesforce application tables through an intuitive wizard. Users can invoke Salesforce actions from within Wave (such as data quality, new campaigns and targeted outreach) and can collaborate using Chatter. Analytics Cloud Smart Data Discovery extends this integration to include automated insights within the user's application context.

- **Partner ecosystem and marketplace:** Salesforce Wave Analytics has a robust partner ecosystem that includes ETL and predictive analytics vendors, independent software vendors and system integrators. Its developer marketplace, AppExchange, provides a platform for independent software vendors/developers to build and sell custom content (such as datasets, lenses and applications). An above-average percentage (more than 30%) of Wave's reference customers report using it for an OEM or embedded use case.
- **Sales and customer experience:** Salesforce's Wave customers report having a positive sales experience and a favorable view of Wave's future, which has improved since the BeyondCore acquisition. Salesforce is among the top vendors for this metric, with among the highest change in perception of vendor viability this year compared with last. Its strong support and product quality capabilities combined with an easy migration experience (that is similar to most cloud offerings) give Salesforce a favorable overall score for its operations.

CAUTIONS

- **Unproven appeal outside the Salesforce installed base:** Due to a focus on Salesforce optimizations and customer-facing Wave-enabled apps, Wave continues to appeal primarily to the Salesforce installed base with most of their data in the cloud (particularly in Salesforce) and who want to augment it with on-premises data. BeyondCore (Analytics Cloud Smart Data Discovery) could help to expand Salesforce's reach to the analyst and citizen data scientist across the enterprise within existing Salesforce enterprises, as well as to non-Salesforce user organizations, but this is yet to be proven. Current Wave reference customers report that more than 76% of data analyzed in Wave originates in the cloud, with more than 88% of customers — more than for any other vendor in this Magic Quadrant — using Salesforce as their primary enterprise application vendor.
- **Functional gaps:** Most Wave customers continue to use the platform for centralized provisioning of management dashboards, which is consistent with its low complexity of analysis (including low scores for complexity of data). The uses of the platform and complexity of analysis supported may expand as BeyondCore is more tightly integrated into Wave during the next year and beyond. Despite improvement during the past year, self-service data preparation, advanced data exploration and manipulation for the business analyst, extensive geospatial capabilities and hybrid cloud querying of on-premises data in place, continue (among others) to be works in progress.
- **Cost:** Salesforce continues to evolve its Wave and BeyondCore (Analytics Cloud Smart Data Discovery) pricing model, but reference customers continue to cite the cost of its software as the main barrier to its broader deployment (by a higher percentage than most other vendors in this Magic Quadrant).
- **Nascent self-service data preparation:** While the new self-service data preparation feature of Wave (Data Designer) makes it easier to access

and harmonize multiple datasets without coding, complex data and data models involving non-Salesforce data still require third-party ETL partners. This adds to the cost of ownership when complex data modeling is a requirement.

SAP

SAP delivers a broad range of BI and analytic capabilities for both large IT-managed enterprise reporting deployments and business-user-driven data discovery deployments. Companies often choose SAP as their enterprise BI standard, especially if they also standardize on SAP applications. With the introduction of SAP BusinessObjects Cloud in 2016 (formerly called SAP Cloud for Analytics) SAP now offers two distinct platforms: SAP BusinessObjects Enterprise for on-premises deployments, and SAP BusinessObjects Cloud as a purely cloud-based deployment (built on SAP's Hana cloud platform). SAP's new Digital Boardroom solution is built on the SAP BusinessObjects Cloud platform.

Several of SAP's BI and analytic components were not considered in this Magic Quadrant. (Components, such as Design Studio, Dashboards, Crystal Reports, Web Intelligence, Analysis for Office, are addressed in the Market Guide for traditional enterprise reporting platforms.) This Magic Quadrant is focused on SAP Lumira in combination with the SAP BusinessObjects platform capabilities and the new SAP BusinessObjects Cloud platform.

SAP's position is in the Visionaries quadrant. While SAP's momentum has increased, particularly in its installed base, it still does not have the broad market momentum of the Leaders in this space. Moreover, despite an above-average rating for customer experience, lower scores for operations including product quality and support affected its position regarding Ability to Execute. On the Completeness of Vision axis, SAP's visionary product capabilities lean toward establishing an early position in the emerging smart data discovery segment — likely to be the next wave of disruption in the BI and analytics market. SAP's full spectrum of critical capabilities for a modern BI platform, focus on innovation, improving customer experience, and global presence as a megavendor make it well-positioned to regain a leadership position in the modern BI segment, if its momentum on all fronts continues.

STRENGTHS

- **Complementary to enterprise reporting platforms:** SAP has strengthened its position in the modern BI market segment. Among the top three reasons for reference customers to select SAP Lumira or SAP BusinessObjects Cloud were ease of use and user autonomy, respectively. With an average deployment size for its modern components of a little less than 300 users (which is about 25% of the overall average deployment size for this Magic Quadrant), it often complements SOR reporting platforms. SAP's use cases are fairly equally split between the agile centralized BI provisioning, decentralized analytics and governed data discovery use cases. Four out of 10 reference customers did not have SAP as their enterprise standard.

- **Customer perception:** SAP's reference customers indicate that their view of its future is positive (with an above-average score). Its solutions are also successfully used within the clients' organizations, as indicated by a score in the top third for success in the organization (a significant improvement over last year). Only a few clients intend to discontinue using SAP (putting it in the top third of vendors for this metric). Both platforms demonstrated growth and increased adoption.
- **Vision:** Product roadmap and future vision were among the top five reasons for reference customers selecting SAP, although this was more important for SAP BusinessObjects Cloud than for SAP Lumira. The integrated vision of planning, analytical and predictive capabilities in a unified, single platform — SAP BusinessObjects Cloud — and its product vision toward smart data discovery capabilities is also promising.
- **Digital Boardroom is a differentiator:** SAP's Digital Boardroom solution, which is built to be used with large touchscreen displays, has gained a lot of attention. It speaks well to the vision of a data-driven company and is particularly attractive to executives because it includes "what if" analysis and simulations. SAP can leverage its strategic position in a customer base of large enterprises and also protect its installed base against smaller vendors with less access to (and visibility with) senior executives.

CAUTIONS

- **Product quality:** Developing two product lines in parallel can be a real challenge, even for an organization of SAP's size. It may therefore come as no surprise that SAP's reference customers expressed their concerns about product quality and performance. The highest percentage of SAP reference customers (compared with the other vendors in this Magic Quadrant) identified software quality as a limitation to wider deployment; it was also placed in the top quartile for poor performance. Absent or weak functionality was the biggest platform problem for SAP's clients. This is an important area that SAP needs to address in order to not stress-test its clients' confidence and to increase its Ability to Execute in the market.
- **Limited interoperability between on-premises and cloud:** SAP BusinessObjects Cloud has an appealing and modern design, but currently offers less-mature capabilities than SAP BusinessObjects Enterprise. There is a limited degree of interoperability between the two platforms — mostly at the data level and not at the level of analytic applications and artefacts. This means there is no clear migration path to the cloud for on-premises deployments. In addition, the two platforms have different pricing and licensing models, which means that a user wanting to use both platforms for analytics would need two different licenses.
- **Simplification work in progress:** Despite the progress SAP has made in pursuing its product simplification strategy, there are still components with overlapping capabilities in the SAP BusinessObjects Enterprise platform (such as SAP BusinessObjects Mobile and the recently acquired

Roambi). Consequently, clients may still be confused about which component to use. Clients should validate the product's position in SAP's strategic roadmap for each subsequent investment decision. Particular attention should be paid to evaluating the announced merger of SAP Lumira and SAP Design Studio into one product in the first half of 2017.

- **Support:** Similar to last year's results, support quality is an issue for SAP's clients. Reference customer scores for response time and the time it takes to resolve issues put SAP in the bottom quartile (and the lowest position among the megavendors). Even though SAP's user enablement score was in the top quartile, the availability of skilled resources was an issue; it should therefore invest in its large partner base to address this.

SAS

SAS offers a wide range of BI and analytics capabilities: from interactive discovery, dashboards and reporting for mainstream business users, to specialist tools for data scientists, as well as prebuilt solutions for industry verticals. SAS Visual Analytics is available either in an on-premises deployment or through the cloud in SAS's own data centers or through third parties such as AWS. SAS Visual Analytics is an in-memory product for governed data discovery, dashboards and advanced analytics that runs on the SAS Lasr Analytic Server. SAS Visual Statistics, which is outside the scope of this Magic Quadrant, is an add-on to SAS Visual Analytics that provides a graphical user interface for citizen data scientists to refine predictive models while exploring data within Visual Analytics. SAS Office Analytics includes SAS Enterprise Guide and Microsoft Office integration with Excel, PowerPoint, Outlook and others. SAS Enterprise Guide is a desktop product that allows power users to perform self-service data preparation and advanced analytics that can then be published to a SAS Visual Analytics server.

The last major release of Visual Analytics was 7.3, in mid-2015. SAS is in the midst of rearchitecting the product to run on SAS Viya, a microservice architecture that will allow clients to seamlessly navigate between on-premises and cloud data stores and deployments. Customers currently running on version 7.3 can upgrade to 7.4 on their current SAS 9.4 platform. Net new customers would run SAS Visual Analytics 8.1 (based on the Viya platform), which is due to be released in 1Q17.

SAS is positioned in the Visionaries quadrant. Its Completeness of Vision rating is driven by its strong global presence, robust vertical industry solutions, and a solid product vision that includes smart data discovery powered by machine learning, microservice architecture, content analytics and the current ability to leverage Hadoop Distributed File System (HDFS). Its position on the Ability to Execute axis was hampered by low reference customer scores for sales experience and operations.

STRENGTHS

- **Complexity of analysis:** SAS scores above the average for this Magic Quadrant on complexity of analysis, with the ability to ingest data from multiple and diverse data sources and an ability to handle complex data models. In addition, SAS customers show a range of usage patterns that

include data preparation, advanced analytics and complex analysis, as well as the more basic parameterized reports and dashboards. SAS differentiates itself on its advanced analytics capabilities, which include forecasting, text analytics and decision trees via a visual point-and-click interface. These models can be enhanced and refined by data scientists in the integrated Visual Statistics product.

- **Global, stable reach across industries:** In a crowded market of startups, SAS continues to be one of the larger vendors, with a solid global presence. As one of the largest, privately held software companies (with more than \$3 billion in revenue), SAS is less subject to investor scrutiny and the profitability concerns of smaller and publicly held companies. While some software vendors have faced workforce reductions, SAS prides itself on never having had employee layoffs, with minimal outsourcing of nonessential staff. In addition to its geographic reach, SAS is used across multiple industries and functional domains — bolstered by its prebuilt analytic solutions such as fraud detection, cybersecurity, customer intelligence, retail and life sciences.
- **Data access and scalability:** Reference customers cite data access and scalability as top reasons for selecting SAS. Its reference customer scores also placed it in the top quartile for accessing Hadoop and NoSQL data sources. SAS is in the top half of the vendors in this Magic Quadrant in terms of the data size of its deployments, with 19% of its customers analyzing 1TB or more of data. However, SAS is also used for much smaller data volumes, with 24% of customers analyzing 50GB to 100GB, and 11% less than a 1GB.
- **Robust product:** SAS has some of the highest scores from its reference customers for product functionality. Sixty-four percent of customers use it for decentralized analytics, and 40% for agile, centralized BI provisioning. SAS is one of the few vendors that can provide both Mode 1 capabilities (formatted reports, with scheduling, distribution and governance) and Mode 2 capabilities (with interactive visual exploration and data preparation).

CAUTIONS

- **Disjointed product and workflow:** SAS essentially has three products that make up its modern BI capabilities. There is interoperability between the products: for example, models authored in the desktop Enterprise Guide can be published to the SAS Visual Analytics Server; and dashboards authored in Visual Analytics can be consumed in Office Analytics. However, this portfolio results in multiple installations, a disjointed workflow and a complicated purchasing process. Enterprise Guide and Office Analytics are optional products to SAS Visual Analytics, but the totality of these modules provides the maximum functionality for modern BI. Moreover, even within the single SAS Visual Analytics product, the dashboard and report authoring interfaces are somewhat disparate.
- **Ease of use and visual appeal:** Ease of use was cited as a concern in last year's Magic Quadrant, and with no new product releases there has

been no improvement. SAS's reference scores put it in the bottom quartile for composite ease of use and for each separate metric (ease of administration and implementation, ease of authoring and ease of consumption). Seventeen percent of reference customers cite difficulty in implementing the product (the second highest of any vendor in this Magic Quadrant); this becomes an area of even greater concern when a vendor has major rearchitecting to do and the degree of difficulty to migrate to the new platform often increases. This year, we asked reference customers to assess visual appeal; on this point, SAS's scores put it in the bottom quartile. A new, modern interface is a key part of SAS Visual Analytics 8.1, due in 1Q17.

- **Sales experience:** Like last year, reference scores place SAS in the bottom quartile for sales experience, which includes presales, contract negotiation and post sales experience. The levels of complaint about the cost of software have improved during the past two years; nonetheless, SAS continues to have a broad portfolio to sell without a specific focus on the BI and analytics platform, which may have negative impact on the effectiveness and quality of the sales experience. In addition, requests to review SAS contracts account for a larger portion of SAS inquiries compared with other BI and analytic inquiries. Customers complain that products are not itemized, making it unclear what is part of the purchased solution and creating difficulties in comparing with other potential products.
- **Operations:** SAS's reference scores put it in the bottom quartile for operations, which includes product quality, technical support and migration experience. These shortcomings put SAS in the second highest position for vendors whose reference customers plan to discontinue using their products (16%).

Sisense

Sisense offers a single platform with a self-contained in-memory, in-chip, columnar database engine that allows for visual exploration of web-based dashboards. Sisense is a privately held company based in New York City, U.S., with R&D facilities in Israel and Kiev, Ukraine. The company has received \$100 million of venture capital funding to date. Sisense has a strong OEM partner network that now accounts for 50% of the company's revenue.

Sisense has moved from the Niche Players quadrant to the Visionaries quadrant this year, based on improvements in its sales strategy and product roadmap. Sisense has delivered several innovative features during the past year, including capabilities that leverage Amazon's Alexa personal digital assistant (PDA) for voice-enabled query and interpretation of results, as well as Sisense bots. The company's longer-term roadmap focuses on smart data discovery, smarter data preparation and crowdsourced analytics. However, Sisense has some shortcomings in its product line in terms of cloud and advanced analytics, as well as less market awareness of Sisense and the competitive risks associated with a smaller vendor in a crowded market; the combination of these factors lowers the company's position on the Ability to Execute axis.

STRENGTHS

- **Ease of use on complex data models:** Customers select Sisense primarily for the product's ease of use; reference customer scores place it in the top quartile for ease of use on content development and user consumption. Power users and administrators can readily ingest multiple data sources into an ElastiCube that supports multiple fact tables and analysis on complex data models. Sisense has recently improved the variety of data sources it can ingest — to include Hadoop — and will also allow data to stay in place if an analytic data store such as a data warehouse already exists.
- **Customer experience:** Reference customers rate Sisense highly for its skilled resources, both internal and external (placing it in the top quartile). In this aspect, every employee is measured on their Net Promoter Score, an index of how likely a customer is to recommend the product to others. Last year, user enablement was an area of weakness for Sisense, but is an area that the vendor has focused on to improve. The company now has a dedicated community manager and offers ongoing webinars and workshops to facilitate customer enablement; these efforts have now put Sisense in the top quartile for user enablement. Continuous and good user enablement further leads to the achievement of business benefits, where Sisense is also rated in the top quartile.
- **Inside sales:** Sisense mainly relies on inside sales staff for its direct sales model. The vendor aims for 90 minutes to insight on production data, as inside sales reps will walk a customer through the installation, data access and design process over the phone. This is in contrast to some competitors that would require consulting services to achieve any insights. The degree of satisfaction with the sales process is reflected in Sisense being placed second overall for the quality of the sales experience.
- **OEM and embedded use case:** Sisense has focused some of its marketing messages on the OEM market, which now accounts for 50% of its revenue. According to its customer references, 43% of customers use it for the OEM and embedded use case (putting it in the top quartile). The abilities to "white label" the product and use APIs to extend and embed Sisense analytic content are key requirements for this use case that Sisense fulfills.

CAUTIONS

- **Complexity of analysis:** A relatively high percentage of reference customers (55%) use Sisense primarily for parameterized reports and dashboards. To an extent, this is part of the company's vision for "Sisense Everywhere," in which the bulk of users may only have simpler requirements. Sisense is used less often for interactive visual exploration, predictive analytics, or business user data integration and preparation. This pattern of less sophisticated usage affects the complexity of analysis (where Sisense is placed in the bottom third of all the vendors in this Magic Quadrant). This shows that much of the data preparation and modeling remains in the hands of a few administrators, a

point of weakness and a contrast to competitive products that give individual users more autonomy.

- **Data volumes and deployment sizes:** Despite Sisense's technical ability to handle large data volumes and messaging, the majority of its reference customers (96%) are analyzing less than 500GB of data. While deployment sizes have grown somewhat in 2016, 62% of Sisense's customers' deployments have fewer than 100 users, placing it in the bottom half of the Magic Quadrant vendors for deployment size. Despite these smaller deployment sizes, Sisense is placed in the top quartile for being the only enterprise BI and analytics standard; 73% of its reference customers recognize it as the standard, albeit for smaller organizations on average.
- **Cost:** Sisense differentiates itself on a low total cost of ownership, based on a single platform. However, 24% of reference customers say its software costs are a barrier to wider usage. Sisense did increase its entry price in 2015, and its licensing model is subscription-only — so customers may be responding to these differences. However, based on survey averages and list prices, Gartner assesses Sisense's cost of ownership as low and its licensing costs as being in line with those of its chief competitors.
- **Product limitations:** The Sisense platform has a relative weakness in embedded advanced analytics, primarily relying on R and external graph libraries to support this capability. Absent or weak functionality was cited as the most common platform problem reported for Sisense (by 16% of its reference customers). However, a number of key features were released in November — as part of the 6.5 release — including improvements to mobile, notifications and enterprise readiness. Sisense has a major release every quarter, with minor releases each month.

Tableau

Tableau offers a highly interactive and intuitive visual-based exploration experience for business users to easily access, prepare and analyze their data without the need for coding through three primary products: Tableau Desktop, Tableau Server and Tableau Online (Tableau's cloud offering). Since its inception, Tableau has been sharply focused on making the analytic workflow experience for users easier, but at the same time giving them greater power to explore and find insights in data. Tableau achieved extraordinary growth and has disrupted the market by appealing to business buyers, which propelled its "land-and-expand" strategy.

During the past year, the maturity of the modern BI and analytics market has led to buyers expanding deployments across the enterprise. This has forced Tableau to place a much greater emphasis than in the past on enterprise features that appeal to an IT buyer — as part of a shift in strategy toward large-enterprise deployments and sales.

Tableau is one of three vendors positioned in the Leaders quadrant this year. Tableau continues to be perceived as the modern BI market leader — still slightly ahead of Microsoft on overall execution. While growth continues for

Tableau, it is at a much slower pace due to pricing and competitive pressure from Microsoft; also from other traditional BI vendors that already have a footprint in the relevant accounts, often as the existing standard for enterprise reporting, and have improved their offerings to the point where they are now more appealing to their installed bases. Tableau's efforts to build product awareness and win mind share globally have contributed to its Completeness of Vision; as did its roadmap, which includes areas of future differentiation such NLP and search, machine-learning-enabled data preparation and smart data discovery. However, most new product investment is focused on closing the gaps in enterprise features, moving to the cloud, supporting larger and more complex governed datasets, and on making its visual exploration paradigm easier, as opposed to spending on disruptive areas of innovation. Tableau must try to balance both areas of development.

STRENGTHS

- **Gold standard for intuitive interactive exploration:** Tableau's core product strengths continue to be its intuitive interactive visualization and exploration and analytic dashboarding capabilities for almost any data source — leveraging an extensive set of data connectors with both in-memory and direct query access for larger datasets. The popularity of this combination with business users drove the market disruption for which Tableau is now well-known and the shift to modern BI and analytics. Tableau 10 further streamlines exploration and content creation workflow for core users by further automating routine tasks, such as geocoding and the creation of time hierarchies on data fields, adding type-ahead for formula building, and new drag-and-drop clustering in addition to existing advanced analytics functions for forecasting and trends. Tableau's reference customers continue to purchase the product for its user experience at a higher rate than for most other vendors in this Magic Quadrant, and score its ease of use among the highest of all these vendors.
- **Focus on customer experience and success:** All aspects of customer experience and operations (among Tableau's reference customers) have improved this year compared with last year, and it scores above the vendor average for this Magic Quadrant. This includes a top quartile score for the primary measure of success — achievement of business benefits. The key to customer success is user enablement, where Tableau's references give it top scores across all categories as well as for availability of skills from both the market and the vendor. Tableau offers a vast array of learning options — including online tutorials, webinars and hands-on classroom-based training — to educate and empower its users, which has increased the number of skilled Tableau resources available in the market along with Tableau Public, its online community and its extensive network of Alliance Partners.
- **Expanding deployments and standardization rates:** Some organizations prefer to use Tableau to empower centralized teams to provision content for consumers in an agile and iterative manner, while others adopt a more hands-off approach and enable completely decentralized analysis by business users. Tableau deployments are

expanding and become a BI and analytics standard in most of its customer base, with survey customers either considering the platform to be "one of" (39%) or "the" (43%) enterprise standard. Moreover, Tableau's reference customers report above-average deployment sizes compared with the other vendors included in this Magic Quadrant — driven by 41% of those organizations reporting average deployments of more than 1,000 users.

- **Flexible deployment options:** Tableau can be deployed in the cloud, with Tableau Online, or on-premises. Tableau was early to the cloud, initially relying on deployment in its own data centers. Tableau has evolved its cloud deployment options to also provide prepackaged virtual machines for AWS and Microsoft Azure in order to simplify deployment and support for the Google Cloud platform (although hybrid support for on-premises data is on the near-term roadmap). Tableau Server is available as bring your own license (BYOL) on the Azure and AWS Marketplaces; it is also available in pay-by-the-hour on AWS Marketplace. About half of Tableau's reference customers say they either have, or are planning, deployment in the cloud, which is slightly less than the 51% average for vendors in this Magic Quadrant.

CAUTIONS

- **Mainstreaming of core innovation:** Visual-based data exploration (Tableau's primary disruptive capability) is, while still a differentiator, now being offered by most players in the modern BI market. This includes many traditional vendors (with large installed base market shares) that newly appeal to these customers through a combination of good-enough functionality, enterprise features and integration with years of investment in SOR content and favorable pricing. While Tableau is viewed as the gold standard, the value of that distinction has diminished as feature differentiation narrows, competitive options grow, and enterprise features and price versus value for money factor more in the purchasing decision than before. This has caused increasingly competitive and contested expansion and enterprise deals. Moreover, Tableau's need to improve its enterprise features diverts investment from the "smart" next-generation capabilities that will be the cornerstone of future competitive differentiation.
- **Pricing and packaging:** Cost of software and complex packaging, particularly as low-cost options grow, is a challenge for Tableau. One of Tableau's few below-average-rated execution measures continues to be sales experience (with among highest percentage of reference users citing cost as a limitation to broader deployment). With increased price sensitivity in this market, new lower-priced market entrants are being considering by and appealing to buyers, particularly for the more lightweight users in larger deployments. Tableau has responded to this competitive pressure by streamlining its packaging, being more flexible in terms of discounting on large deals and moving to subscription pricing during 2016 in order to address this purchasing barrier.
- **Lack of complex data model support:** Tableau supports a diverse range of data connectivity options — spanning relational, online

analytical processing (OLAP), Hadoop, NoSQL and cloud sources — but offers weaker capabilities when it comes to integrating combinations of these sources in preparation for analysis. While harmonized data can now be reused in Tableau 10, complex multifact table data models are not yet supported and must be created elsewhere when needed. Moreover, poor performance for large in-memory extracts often requires modeling in a separate data repository that is directly queried from Tableau. Tableau reference customers score it in the bottom quartile for average number of data sources accessed from the platform, while at the same time reporting that they access among the highest data volumes for queries — which likely reflects the approach that Tableau has taken of leveraging an underlying data warehouse if one exists. Tableau has announced its plans to release a stand-alone self-service data preparation tool (code-named Project Maestro) in 2017, to address its customers' challenges with large and complex data.

- **Many enterprise features a work in progress:** Most new product investment on Tableau's roadmap is targeted at closing current enterprise feature gaps — such as adding support for Linux, replacing the TDE file format with a new in-memory engine (Hyper) to support larger datasets, and improving APIs for better embeddability and extensibility. Event-based scheduling, conditional alerting, printing to PDF and PowerPoint, and collaboration and social platform integration are also works in progress. Currently, many of these gaps are filled by partners such as Metric Insights and Computer Intelligence Associates, which again adds to the TCO.

ThoughtSpot

ThoughtSpot makes its first appearance in this year's Magic Quadrant. The company was founded in 2012, launched in mid-2014, and was nominated a Cool Vendor by Gartner in 2016. ThoughtSpot's main differentiator is its search-based interface to visual exploration; several of the company's founders come from Google. As of December 2016, the company has 135 employees and has received \$100 million of venture capital funding.

The product is primarily deployed as an on-premises appliance on commodity hardware, with data loaded in-memory and indexed for fast query performance. The vendor recently introduced cloud-based deployment options in Microsoft Azure, AWS and VMware. ThoughtSpot is often deployed in addition to other BI products, partly because it is a new market entrant and also to serve a particular class of users that are more focused on ease of use than advanced capabilities for data manipulation.

ThoughtSpot is positioned as a Niche Player, because it currently serves a relatively narrow set of requirements and therefore lacks some of the product functionality found in more mature products serving a broader set of users and use cases. Smart data discovery is part of ThoughtSpot's product roadmap, but its placement on the Completeness of Vision axis is hampered by limitations around product partnerships, vertical solutions and broad geographic presence.

STRENGTHS

- **Ease of use via search:** ThoughtSpot uses a search-based interface for users to explore and visualize data. The product uses a columnar, in-memory engine that indexes all of the searchable data to ensure fast performance on large datasets. Machine-learning algorithms provide a type-ahead search experience. Reference customers scored the ease of use as above average, while for ease of deployment and administration it was in the top quartile. ThoughtSpot was rated in the top half of all the vendors for complexity of analysis, based primarily on breadth of usage. While the largest percentage of users (46%) are doing simple ad hoc analysis, an above-average 29% are performing moderate to complex analysis.
- **Support:** ThoughtSpot's reference scores rated it the second-highest vendor for technical support — in the time to respond, time to resolve the issue, and in the level of expertise provided by the support technician. To a certain extent, this is facilitated by having a limited product portfolio, but quality of technical support can be an important differentiator in a crowded market; and one in which lines of business may initially deploy products with little or no support from IT.
- **Skilled resources:** The demand for skilled resources in the BI and analytics market is a challenge both for customers and vendors. ThoughtSpot is based in Palo Alto, California, U.S., where startups vie for top talent. Reference customer scores for the availability of skilled resources from ThoughtSpot placed it second overall. Vendor-supplied resources are particularly important during implementation and when there is a limited supply of third-party consultants, as is the case with ThoughtSpot.
- **Product vision includes smart data discovery:** Gartner believes that the next round of disruption in this marketplace will come from smart data discovery. ThoughtSpot includes several of these capabilities in its near-term roadmap (due in early 2017). The vendor refers to these capabilities as "A3" — auto, awesome and analytics. Charts are generated automatically with a short textual explanation about the most important outliers and trends.

CAUTIONS

- **Niche product requires data replication:** As more casual users interact with and explore data, the system must ensure fast performance. ThoughtSpot achieves this by replicating the data, thus limiting the range of datasets that can be accessed and explored via this interface. Competitive solutions in the marketplace aim to provide search and/or NLQ without requiring data movement. As a less mature product, ThoughtSpot also lacks the range of charting, data manipulation and mobile capabilities that its competitors offer. Of ThoughtSpot's customer references, 23% cited absent or weak functionality as a barrier to wider deployment.
- **Limited land-and-expand pricing or strategy:** Much of the BI and analytics market has moved to a land-and-expand strategy in which individual business users can trial a product, assess if it meets their

requirements, move to a prototype, then make incremental purchases based on a successful deployment. ThoughtSpot, meanwhile, has a time limited try-and-buy downloadable version, with an online version planned in 2017. While the starting price for a paid deployment has recently been lowered, it remains a barrier to entry. This is a step in the right direction, but it is a point of difference from competitive trial solutions that are free for an individual user or free for a specific time period and then have a low-cost option to begin paid use for small numbers of users as a steppingstone to wider expansion. While this pricing and packaging is an initial barrier to adoption, customers do not complain about cost as a barrier to its broader deployment.

- **Limited geographic presence, partnerships and community:** As expected of a startup vendor, ThoughtSpot lacks the geographic presence of its larger competitors. Support is provided only through the U.S., with staff located in the U.S. and U.K. There are no vertical industry templates and its limited partnerships suggest that these will not be built out by partners. The vendor scores below average for user enablement, and more specifically is in the bottom quartile for community and user conferences (two aspects of user enablement).
- **Business benefits:** Achievement of business benefits is the ultimate goal of BI and analytics, with a focus on specific business outcomes such as improving revenue, controlling costs or ensuring high levels of customer service; this metric factors into a vendor's position in on the Ability to Execute axis. ThoughtSpot's customers' achievement of business benefits was good, but in the bottom quartile relative to other vendors in this Magic Quadrant. Also, the benefits achieved were the softer, more qualitative benefits such as making better decisions faster and extending BI to more users, rather than hard business benefits such as improved revenue.

TIBCO Software

Through its acquisition of Spotfire in 2007, TIBCO Software became one of the data discovery disrupters that helped drive the BI market shift from traditional reporting to modern BI and analytics. The platform offers extensive capabilities for analytics dashboards, interactive visualization and data preparation in a single design tool, while offering flexible processing options either in-memory or in-database. It has continued to expand its feature set to include advanced analytics and streaming, and location intelligence, largely through acquisition and integration with TIBCO middleware. TIBCO also acquired Jaspersoft in 2014, to support embedded and traditional reporting use cases. (Due to its IT-centric reporting focus, Jaspersoft is covered in the Market Guide for traditional enterprise reporting platforms — not in this this Magic Quadrant.)

During the past year, TIBCO has sharpened its product development focus and investment on Spotfire and has broadened its land-and-expand sales capabilities in an effort to revitalize the market momentum that suffered a decline after the company was privatized in 2014. However, in an increasingly crowded market, TIBCO still generates less awareness among potential new

customers (compared with its competitors) than we would expect, given its competitive product portfolio.

TIBCO is positioned in the Visionaries quadrant due to its investment in automating and recommending insights for smart data discovery, streaming and location analytics. Strong product scores from its reference customers, and an improved customer experience, have helped TIBCO's position on the Ability to Execute axis, while a loss of mind share and momentum relative to the Leaders has detracted from it.

STRENGTHS

- **Well-suited to advanced data exploration:** Although Spotfire can be used for a range of use cases, customers select and use Spotfire for its ease of use in conducting advanced and complex analysis and reference customers score the platform as above average for this metric. The platform features an integrated self-service data preparation tool for building complex data models and a single highly rated design environment for interactive visualization and building of analytic dashboards. Within that environment, analysts have access to an extensive library of embedded advanced analytic functions, with many drag-and-drop capabilities. This includes geospatial algorithms and data and integrated access to TIBCO's optional data science runtime engine for the R analytic language, TIBCO Enterprise Runtime for R (TERR). A higher percentage of TIBCO Spotfire's reference customers said they selected Spotfire for its advanced analytics/data science integration than for any other vendor in this Magic Quadrant.
- **Loyal global customer base of advanced users:** Because of its support for advanced exploration, Spotfire appeals to customers predominantly focusing on decentralized deployments that consist of users with a range of skills levels, but it has particular appeal to advanced users such as scientists and engineers. These types of users have made Spotfire entrenched in many large global organizations across many industries. In particular, it is used in life sciences (through its partnership with PerkinElmer) and in engineering departments in the oil and gas, retail and consumer packaged goods and utilities industries, as well as in manufacturing domains. Seventy-five percent of Spotfire reference customers said they use it for decentralized deployments; this is the highest percentage of any vendor in this Magic Quadrant. These large, mature and mostly decentralized deployments have contributed to Spotfire's above-average score for deployment size (by number of users).
- **Improved user enablement:** TIBCO's increased investment in user-enablement assets such as a new user community is beginning to pay off. Reference customers scored TIBCO as slightly above average for training, documentation, online communities and online tutorials. While availability of skills from the vendor is also scored as being above average, availability of skills from the market is below average, which is not uncommon for smaller vendors with less market traction. These results will help TIBCO to improve awareness of it in the market as well as customer success with the product, both of which are necessary

precursors to broader market adoption. These are also important drivers for achieving business value from the platform; an area where TIBCO is also starting to see an improvement (according to its reference customers).

- **Improved customer experience and view of future:** TIBCO's intensified focus on Spotfire, and specific investments in sales and customer experience, appear to have improved its customers' view of its future viability and success this year, compared with last year — reversing a couple of years of a negative trend after TIBCO's privatization. In particular, most reference customers report an above-average experience with support, product quality and migration experience.

CAUTIONS

- **Cost:** While TIBCO seems to have achieved positive results through a focus on improving sales execution issues — with above-average and improved scores this year compared with last year — when asked about limitations to wider deployment, an above-average percentage of reference customers (roughly one in five) cite license cost as a barrier to their broader deployment of Spotfire. While Gartner has seen some Spotfire contracts with more attractive pricing for new customers, in a crowded market the downward pricing pressure will continue for Spotfire.
- **Product areas for improvement:** While TIBCO's overall product score is above average and a larger percentage of buyers select the platform for its functionality than most other Magic Quadrant vendors, a few important gaps exist. Self-service data preparation offers limited impact analysis, digital watermarking of certified data sources, and has some gaps in advanced data inference. Native mobile support is limited to the iOS only and there is no support for offline exploration. While TIBCO is investing in a cloud-first strategy, its reference scores for Spotfire put it in the bottom quartile for customers either currently deploying or intending to deploy Spotfire in the cloud. Spotfire has an average score for its cloud BI capabilities, with limitations around packaged content, cloud authoring and a robust content marketplace. Moreover, publish, share and collaborate features are scored as average due to limitations in storytelling and user content ratings and no integration with social platforms other than Twitter and TIBCO's tibbr.
- **Less intuitive content authoring for casual business users:** While the Spotfire platform is a powerful exploration tool that appeals to analysts who know the product well, it is less intuitive than some competing products for new users and casual business users who simply want to assemble lightweight dashboards and analysis. Some Gartner Peer Insights customers also report usability challenges with the administration, but this may be reflective of versions prior to 7.5 — after which Spotfire claims to have improved such usability.
- **Rarely the enterprise standard:** Spotfire has among the lowest percentage of reference customers deploying it as the only BI and analytics standard, but it has among the highest percentage of survey

customers reporting they use Spotfire as one of their organization's BI and analytics standards. This is consistent with its high levels of use for decentralized deployments.

Yellowfin

Yellowfin delivers a single, web-based BI and analytics platform with several innovative capabilities in collaboration features, storytelling, and a tightly integrated set of tools ranging from data integration to dashboard creation. Yellowfin represents the modern design of a central enterprise BI platform and is well-suited to embedded analytics. Yellowfin has a strong indirect channel with more than 250 partners worldwide, achieving most of its revenue through resellers, distributors and OEM partners.

Yellowfin continues to be positioned in the Niche Players quadrant. It is well-suited to centralized SOR reporting and dashboards, and as an embedded solution with differentiators around integrated collaboration and social capabilities. It is focused in Asia/Pacific and while it is investing in some areas of vision, such as NLP/search and a marketplace, it scored relatively low on product vision compared with other vendors in the Magic Quadrant. Its sales, customer experience and operations scores also contributed to its position on the Ability to Execute axis.

STRENGTHS

- **Easy to use for reporting and dashboards:** The Yellowfin platform has its strength in ease of use for the end users, and provides leading capabilities for collaboration and social — such as timelines and discussion threads. The platform offers excellent capabilities for analytic dashboards, including those delivered on mobile devices or embedded in applications, with good geospatial and location intelligence features in combination with prepackaged content and GeoPacks that are available via its marketplace.
- **Well-suited to midsize companies:** Yellowfin is successful as a modern enterprise reporting platform for midsize companies. It is in the top quartile of vendors for its use as the enterprise standard by its reference clients. About 80% of Yellowfin's reference customers have deployment sizes of less than 250 users, despite some with large deployments of more than 1,000 users. The average company size of Yellowfin reference customers, at 2,125 employees, was the lowest across all vendors in this Magic Quadrant.
- **Fit for the partner channel:** Yellowfin's completely web-based platform and flexible licensing terms make it attractive to partners. The DashXML component supports developers for content creation and development processes for analytic applications, which has been particularly well received by Yellowfin's large OEM partner network. Not surprisingly, OEM/embedded analytics and extranet deployments are the second and third most popular use cases for Yellowfin's reference customers (and among the highest of all vendors in this Magic Quadrant).
- **Cloud ready:** Even though Yellowfin does not offer its platform in a public cloud, it is a web-based multitenant platform with a number of

native connectors for cloud data sources, which is deployed in the cloud by 51% of Yellowfin's reference clients (a score that is above the survey average of 38% actively deploying in the cloud).

CAUTIONS

- **Business operations:** Yellowfin's reference customers gave it low scores for many of the aspects along the customer life cycle, including a bottom quartile rating (of all the Magic Quadrant vendors) for sales experience. In particular, Yellowfin references rate it in the bottom quartile for product quality and migration experience, and give it a below-average score for support. While this weakness in support might be related to Yellowfin's dependence on the indirect channel, it ultimately reflects back on the vendor itself and requires attention if it is to support the customer base effectively in this highly competitive market.
- **Reporting-centric:** Yellowfin's platform strength lies not in more complex analysis, but rather in enterprise reporting. Yellowfin's reference scores put it in the bottom third for breadth of use and at the bottom for complexity of analysis, further confirming its narrow use for enterprise reporting and dashboards. Almost one out of five reference respondents for Yellowfin (above the survey average) named absent or weak functionality as a platform problem. Moreover, while the platform rates as above average for ease of use for content consumers, Yellowfin's reference customers rate it as below average for ease of administration and content authoring along with reporting above-average times to create simple, moderate and complex reports and dashboards.
- **Customer experience:** Despite attractive license costs, Yellowfin's reference customers were less satisfied with the business benefits they achieved than other Magic Quadrant vendors (as indicated by a score in the bottom quartile for this metric). In particular, reducing IT, external and other costs was scored lower, ranking Yellowfin in the bottom third of vendors for this metric. Moreover, Yellowfin references rate it as below average for user enablement and for the availability of skills — both of which help to drive business benefits. In particular, low ratings for user conferences and availability of skills from the market were cited as key issues, which is not uncommon for a smaller vendor.
- **Future outlook:** Vendor viability and the view on its future were scored low by Yellowfin's references, placing it in the bottom quartile relative to other vendors. Despite some differentiating capabilities, Yellowfin's platform continues to be at risk of falling behind other modern BI platforms. Yellowfin's score for market understanding puts it in the bottom quartile, combined with a bottom overall ranked score for product vision. These low scores raise concerns about whether Yellowfin will be able to persist as a modern platform in the emerging market wave of smart data discovery.

Zoomdata

Zoomdata supports fast interactive analysis, visualization and dashboards for big and streaming data. It uses microqueries and Spark to push down query

processing to the underlying big data sources, while estimating results and making them immediately available for interactive analysis as queries are processed. Zoomdata's DataDVR capabilities allow users to rewind, fast forward, analyze and compare historical data with real-time streams. Zoomdata is well-suited to business users and data scientists that need real-time insights from streaming data across a range of big data sources, or for developers that need to embed these insights in applications. Zoomdata had 120 employees, as of October 2016, and had raised \$47 million in venture capital (with the last round in February 2016).

Zoomdata is positioned in the Visionaries quadrant for its Magic Quadrant debut, based on its clear positioning and differentiation. It also has an innovative vision for streaming analytics that is based on a modern distributed architecture, which harmonizes multiple large data sources into real-time interactive dashboards without moving data. Zoomdata's Ability to Execute is limited by its narrowly focused product, weaker customer experience and operations, and lack of a strong geographic presence (being a smaller vendor and with limited customer awareness).

STRENGTHS

- **Native streaming and big data support:** Zoomdata is best-suited to organizations needing to perform real-time interactive analysis on large sets of streaming data. The platform is natively optimized for a range of big data sources, including Hadoop, NoSQL databases, streaming data, search data and cloud data sources such as Google Big Query and DataProc, Microsoft HDInsight and Amazon Redshift, EMR and S3 (among others), with support for in-database processing and in-flight data harmonization. In particular, Zoomdata's data fusion capabilities allow users to combine data from different databases (both structured and unstructured) into a single virtualized data source for exploration and analysis. Reference customers select Zoomdata for its ability to support large data volumes, data access and integration and ease of use for business users. They also report among the highest data volumes for a query when using Zoomdata.
- **Hybrid deployment:** Zoomdata's fast processing is achieved through microquerying data left in place while leveraging the processing power of underlying big data repositories. Instead of one big SQL statement, Zoomdata executes parallelized microqueries and performs calculations on the data as it streams in from the data source. Data is only pulled into Zoomdata's own Spark instance (or into an external one) as a last resort, when this is the best approach for interactive analysis. Zoomdata can be deployed on-premises or purchased with a one-click deployment through the marketplaces of Amazon AWS, Google GCP or Microsoft Azure.
- **Support for complex types of analysis:** Zoomdata tied for first place among all the vendors in this Magic Quadrant for complexity of analysis supported by the range of data sources and breadth of usage. It offers embedded statistical capabilities for building custom calculations and can leverage third-party models such as R and Python. It can also be integrated with Jupyter Notebooks to fit into a data science workflow. Zoomdata's reference customers report that an above-average

percentage of data scientists/citizen data scientists use the platform for complex types of analysis. The platform's extensive use for advanced types of analysis and its support for complex data types are the main reasons for its above-average score for market understanding, despite having slightly below-average ease-of-use scores.

- **Attractive embeddability:** Roughly 40% of Zoomdata's revenue comes from OEMs. In support of this, in 2016, Zoomdata launched the Zoomdata Developer Network to serve the needs of the analytic app market and continue to expand this part of the business. Zoomdata SDKs and extensive REST APIs support the customization and embedding of most aspects of the platform, including administrative functions, connectors and visualizations. While reference customers report using the platform for agile centralized provisioning and decentralized deployments, Zoomdata's scores place it in the top quartile of vendors whose customers report using the platform for embedded or OEM use cases.

CAUTIONS

- **Functionality:** While Zoomdata offers excellent and innovative support for real-time dashboards for streaming data, it is missing many features across the 15 product capabilities assessed. The areas with the largest gaps are mobile, collaboration, scheduling and alerting, and smart data discovery. Some aspects of interactive exploration, particularly advanced interactivity, are also limited. A narrow innovative focus is typical of a vendor positioned in the lower part of the Visionaries quadrant. Customers looking for traditional reporting or interactive analysis against a data warehouse, for example, would not look to Zoomdata as their best option.
- **Customer experience:** While Zoomdata customers report a positive sales experience and above-average support, and achieve above-average business benefits with the platform, its user enablement scores across all components — with near to the lowest scores for user community and conferences — place it in the bottom quartile of all the vendors in this Magic Quadrant. Reference customers also report below-average product quality and migration experiences. This is not uncommon for a small and relatively new startup. However, customer experience and user enablement will be critical areas of improvement if Zoomdata is to deliver ongoing value beyond its initial set of early adopter users that, despite these limitations, have a positive view of Zoomdata's future and report a high degree of success with the platform.
- **Small deployments:** While Zoomdata deployments are large in terms of size of datasets, they have a small number of users and the highest percentage of reference customers reporting that they deploy the platform departmentally (compared with other vendors in the Magic Quadrant).
- **North America focus:** Although 30% of Zoomdata's customers are outside the U.S., Zoomdata is mostly focused on North America, with limited geographic presence and awareness beyond that region.

Zoomdata has employees in North America and Ukraine and the product and documentation is only available in English, with no localization.

Vendors Added and Dropped

We review and adjust our inclusion criteria for Magic Quadrants as markets change. As a result of these adjustments, the mix of vendors in any Magic Quadrant may change over time. A vendor's appearance in a Magic Quadrant one year and not the next does not necessarily indicate that we have changed our opinion of that vendor. It may be a reflection of a change in the market and, therefore, changed evaluation criteria, or of a change of focus by that vendor.

It is important to note that a vendor's exclusion this year does not mean that they will not be included in future years and vice versa.

Added

ThoughtSpot, Datameer, Oracle and Zoomdata were added to the Magic Quadrant this year.

Dropped

- Platfora was acquired by Workday and is no longer being sold as a stand-alone BI platform.
- BeyondCore was acquired by Salesforce and is included in the Salesforce assessment and dot position.
- Datawatch and GoodData were excluded because they shifted their market emphasis.

Inclusion and Exclusion Criteria

This year's Magic Quadrant includes 24 vendors that met all our inclusion criteria, as listed below.

Modern BI and Analytics Platform Assessment

This was evaluated by Gartner analysts and was determined by the extent of IT involvement that is considered to be mandatory before the platform can be used by a business analyst/information worker to analyze data, without IT assistance. Products that require significant IT involvement, either internal or external to the platform, in order to load and model data, create a semantic layer, build data structures as a prerequisite to using the BI platform or are IT developer-centric platforms focused on building analytic applications, do not meet the criteria of a modern BI and analytics platform and were not evaluated further for inclusion. Products that met the modern criteria were evaluated for inclusion in the Magic Quadrant based on a funnel methodology where requirements for each tier must be met in order to progress to the next tier. Tiers 1 to 3 are evaluated at the vendor level; Tiers 4 and 5 are evaluated at the product level.

Vendor-Level Criteria

- **Tier 1. Market Presence** — A composite metric assessing both the interest of Gartner's client base and that of the broader market, through

internet search volume, job postings and trend analysis, was conducted for each vendor.

- **Tier 2. Revenue*** — For those vendors meeting the market presence criteria (Tier 1), BI and analytics revenue for each vendor was assessed and evaluated. For this assessment, two common license models were assessed and revenue from each was combined (if applicable) and evaluated against the three revenue inclusion levels (shown below) for qualification:
 1. Perpetual License Model — Software license, maintenance and upgrade revenue (excluding hardware and services) for calendar years 2014, 2015 and 2016 (estimated).
 2. SaaS Subscription Model — Annual contract value (ACV) for year-ends 2014, 2015 and projected ACV for year-end 2016, excluding any services included in annual contract. For multiyear contracts, only the contract value for the first 12 months should be used for this calculation.
- Revenue inclusion levels are as follows:
 - \$25 million 2016 (estimated) combined perpetual license revenue + 2016 (estimated) ACV, or
 - \$15 million 2016 (estimated) combined perpetual license revenue + 2016 (estimated) ACV with 50% year-over-year growth, or
 - \$10 million 2016 (estimated) combined perpetual license revenue + 2016 (estimated) ACV with 100% year-over-year growth
- ** Gartner defines total software revenue as revenue that is generated from appliances, new licenses, updates, subscriptions and hosting, technical support and maintenance. Professional services revenue and hardware revenue are not included in total software revenue (see "Market Share Analysis: Business Intelligence and Analytics Software, 2015").*
- **Tier 3. Magic Quadrant Process Participation** — Participation in the Magic Quadrant process requires the following input:
 - Completing and providing documentation for an RFP-style questionnaire of detailed critical capabilities.
 - Completing an online questionnaire around market presence, growth, go-to-market strategy and differentiation.
 - Submission of a video up to one-hour long that demonstrates how included products deliver on the predefined analytic scenarios defined by Gartner (we only look at the first hour; anything beyond that is not considered).
 - Verification of final BI and analytics revenue for 2014, 2015 and 2016 (estimated).
 - Providing references for an online customer and OEM survey.

- Providing a vendor briefing to the Magic Quadrant authors.
- Providing access to evaluation software.
- Providing factual review of sections in the Magic Quadrant research.

Product-Level Criteria

- **Tier 4. Breadth of Coverage** — The vendor must demonstrate breadth across vertical industries and geographic regions, as specified by Gartner.
- **Tier 5. Product Assessment** — Products that progressed to this final tier were assessed by Gartner analysts using the information provided by each vendor in the data collection exercise outlined above. The final step involved narrowing down the field to 24 vendors for inclusion in the Magic Quadrant.
- Gartner has full discretion to include a vendor on the Magic Quadrant regardless of their level of participation in the Magic Quadrant process, if the vendor is deemed important to the market. This discretion was not applied this year as all vendors fully participated in the process.

Evaluation Criteria

Ability to Execute

Vendors are judged on Gartner's view of their ability and success in making their vision a market reality that customers believe is differentiated and that they buy into. Delivering a positive customer experience, including sales experience, support, product quality, user enablement, availability of skills, ease of upgrade/migration, also determines a vendor's Ability to Execute. In addition to the opinions of Gartner's analysts, the ratings and commentary in this report are based on a number of sources: customers' perceptions of each vendor's strengths and challenges, as gleaned from their BI and analytics-related inquiries with Gartner; an online survey of vendors' customers conducted during October 2016 (which yielded 1,931 responses); a questionnaire completed by the vendors; vendors' briefings, including product demonstrations, strategy and operations; an extensive RFP questionnaire inquiring how each vendor delivers the specific features that make up our 15 critical capabilities for this market (see "Toolkit: BI and Analytics Platform RFP"); a prepared video demonstration of how well vendors' BI platforms address the 15 critical capabilities; and analyst access to evaluation software.

Ability to Execute Criteria

** Note: These criteria are scored partly or wholly on the basis of input from the Magic Quadrant customer reference survey.*

- **Product/Service***: How competitive and successful are the 15 product capabilities offered by the vendor in this market? How integrated is the workflow of the product? How easy to use and visually appealing?

- **Overall Viability:** What is the likelihood of the vendor continuing to invest in products and services for its customers and how do references rate the vendor's relevance in the future? Viability also includes an analyst assessment of the overall organization's financial health, the financial and practical success of the business unit and the likelihood of the individual business unit continuing to invest in the product, offer the product and advance innovation within its product portfolio.
- **Sales Execution*:** This covers the vendor's capabilities in all presales activities and the structure that supports them. It also includes deal management, pricing, negotiation and contracting, presales support and the overall effectiveness of the sales channel.
- **Market Responsiveness and Track Record*:** Does the vendor have momentum and success in the current market and is this momentum broad or confined to one geographic region?
- **Customer Experience*:** How well does the vendor enable its customers through the availability of training, online tutorials, documentation and conferences, and how available are skilled resources (both in the market and from the vendor) with expertise in its product offerings? It also covers the extent to which customers realize tangible business benefits through use of the vendor's software.
- **Operations*:** How well does the vendor support its customers? How trouble-free is the software, and how easy is it to migrate to a newer version?

Table 1. Ability to Execute Evaluation Criteria

Evaluation Criteria	Weighting
Product or Service	High
Overall Viability	High
Sales Execution/Pricing	High
Market Responsiveness/Record	High
Marketing Execution	Not Rated
Customer Experience	High
Operations	High

Source: Gartner (February 2017)

Completeness of Vision

Vendors are rated on Gartner's view of their understanding of how market forces can be exploited to create value for customers and opportunity for themselves. The Completeness of Vision assessments and commentary in this report are based on the same sources described in the Ability to Execute section.

When determining Completeness of Vision for the Offering (Product) Strategy criterion, Gartner evaluated vendors' ability to support the key trends that will drive business value in 2017, and beyond. Existing and planned products and functions that contribute to the above trends were factored in to each vendor's score for the Offering (Product) Strategy criterion (listed below for Completeness of Vision). These key themes (by category) are as follows:

Infrastructure

- Support for a marketplace (buyers and sellers) where organizations, customers and partners can buy and sell custom-built analytic applications, aggregated data sources, custom visualizations and algorithms that integrate with the BI and analytics platform is beginning to form in the market, but is limited to a subset of vendors.
- Native access to a range of Hadoop, Spark, other NoSQL data sources, graph databases or search databases such as Elasticsearch and Kibana, Attivio or Splunk is becoming increasingly important as data grows in both volume and complexity.
- Support for hybrid deployments across on-premises and the cloud. This ranges from hybrid data support for being able to query on-premises data from the cloud, without first moving it to the cloud, to fully integrated and seamless hybrid on-premises and cloud deployments with a single point of administration, consumption and content authoring.

Data Management

- A curated agile data catalog where business users can search, access, find and rate certified internal data as well as open and premium external data with workflow — in order to promote harmonized data to certified status — is becoming key to governed modern deployments leveraging complex distributed data with an increasing number of distributed content authors.
- Smart data preparation on multistructured data is a core visionary feature in this category, because the need to automatically profile, enrich and infer relationships (to automatically generate a model for analysis), and to make recommendations to improve or enhance insights from the data, will be an area of innovation that will differentiate vendors in the future.
- The ability to automatically promote user-generated models and content to the SOR and reuse and build on existing variables, calculations, models and content is critical to large-scale trusted self-service.
- Modern push-down processing to big data sources, automating the selection of where to best process a query, is an important feature going

forward in order to support large and complex datasets by leveraging big data processing and minimizing the need to move data.

- Support for preparing, harmonizing and leveraging real-time events and streaming data, and pushing real-time results to a consumption layer in support of a range of use cases, is in its infancy but will become an increasingly important data management consideration for organizations to adopt and integrate into analytic solutions in order to enhance their value to the business.

Analysis and Content Creation

- Smart, automated pattern detection capabilities that automate the identification of the patterns and clusters hidden in data that are often missed by analysts manually exploring datasets, is core to next-generation BI and analytics platforms. The automated identification of findings is the key to enabling and expanding access to analytics to more users within the organization and to speeding the time to insight while reducing bias.
- NLP for voice and text to support the concept of a personal analytics assistant that can generate natural-language queries and explain its findings to users using NLG will be a dominant future interface for analytics.
- Support for a broad range of content analytics and text analytics against unstructured data as organizations explore new sources of information to link to, and relate to, the analytical insights derived from structured data sources. NLQ is an important exploration paradigm.

Sharing of Findings

- The ability to invoke business actions from within the platform either in a dashboard or embedded in another application represents a level of sophistication beyond current mainstream support for conditional alerts and event triggering based on system events.
- NLG or narration of insights is the next phase in the evolution from standard reporting to storytelling with descriptive text to augment the visually depicted content.
- Contextual recommendations for relevant content — based on insight gained from collaboration and social interaction by users — will largely replace the need to manually share content and findings across the organization.
- Integrated point-and-click simulation, what-if analysis and optimization extend the types of analysis users need that are today often created using custom calculations.
- Increasingly, organizations need to render analytics content in immersive experiences for different types of users across many touchscreens.

Completeness of Vision Criteria

** Note: These criteria are scored partly or wholly on the basis of input from the Magic Quadrant customer reference survey.*

- **Market Understanding*:** Does the vendor have the ability to understand buyers' needs and to translate those needs into products and services? Ease of use, ability to support complex data requirements, and the types and complexity of analysis users conduct with the platform — all key buying criteria — factor into this rating.
- **Marketing Strategy:** Does the vendor have a clear set of messages that communicate its value and differentiation in the market? Is the vendor generating differentiated awareness?
- **Sales Strategy*:** Does the vendor have an innovative partner strategy, attractive pricing, flexible and clear product packaging, and a strong land-and-expand and enterprise sales model?
- **Offering (Product) Strategy:** Does the vendor's approach to product development and delivery emphasize differentiation and functionality that map to current and future requirements, based on the product vision criteria that are summarized by the key trends described at the beginning of the Completeness of Vision section?
- **Vertical/Industry Strategy:** How well can the vendor meet the needs of various industries, such as financial services, life sciences, manufacturing and retail?
- **Innovation:** Is the vendor focusing its resources, expertise or capital to address key market requirements for competitive advantage? Is the vendor investing in and delivering truly unique and in-demand capabilities? Is the vendor setting standards for innovation that others try to match?
- **Geographic Strategy:** How well can the vendor meet the needs of locations outside its native country, either directly or through partners?

Table 2. Completeness of Vision Evaluation Criteria

Evaluation Criteria	Weighting
Market Understanding	High
Marketing Strategy	High
Sales Strategy	High
Offering (Product) Strategy	High

Table 2. Completeness of Vision Evaluation Criteria

Evaluation Criteria	Weighting
Business Model	Not Rated
Vertical/Industry Strategy	Standard
Innovation	High
Geographic Strategy	Low

Source: Gartner (February 2017)

Quadrant Descriptions

Leaders

Leaders are vendors that demonstrate a solid understanding of the product capabilities and commitment to customer success that buyers demand in the current market, coupled with an easily understandable and attractive pricing model that supports proof of value, incremental purchases and enterprise scale. In the case of the modern BI and analytics platform market, buying decisions are now being made by, or at least heavily influenced by, business users that demand easy-to-use and easy-to-buy products that deliver clear business value and enable powerful analytics with limited technical expertise and without the requirement for upfront involvement from IT. In a rapidly evolving market, with innovation being introduced constantly, a Leader must also demonstrate that it is not focused only on current execution but has a robust roadmap to solidify its position as a future market leader, thus protecting the investment of today's buyers.

Summary of Leaders Quadrant Positions

Consistent with any maturing technology market, net new buying of modern BI platforms is becoming mainstream as organizations that have been successful with smaller deployments are now looking to expand this use across the enterprise and are increasingly making the modern BI platform one of, if not *the* enterprise standard in their organization. Agility and ease of use for business users are still critical buying drivers, but the ability to govern deployments, promote user-generated content to trusted enterprise sources, deal with complex large datasets, extend and embed analytic content and support large global deployments have taken on new importance in the buying decision. There are currently three vendors sufficiently executing on their vision to warrant a position in the Leaders quadrant. However, many of the traditional BI vendors and newer vendors still in the Visionaries quadrant this year are gaining momentum in their installed bases, because of the maturation of their modern BI components and renewed investments in next-generation smart

innovation, and are beginning to pressure and challenge the current market leaders. If this trend continues, we could see either a more crowded Leaders quadrant or new Challengers in future Magic Quadrants.

Challengers

Challengers are well-positioned to succeed in the market. However, they may be limited to specific use cases, technical environments or application domains. Their vision may be hampered by the lack of a coordinated strategy across the various products in their platform portfolios, or they may lack the marketing efforts, sales channel, geographic presence, industry-specific content and awareness of the vendors in the Leaders quadrant.

Summary of Challengers Quadrant Positions

There are currently no vendors executing at a level that would challenge the market leaders, leaving the Challengers quadrant empty this year. However, traditional BI and analytics vendors are gaining traction and putting increased pressure on the market leaders with modern offerings coupled with early investment in next-generation smart data discovery capabilities. If they continue this momentum, we could see these and possibly other vendors in this quadrant next year.

Visionaries

Visionaries have a strong and unique vision for delivering a modern BI and analytics platform. They offer depth of functionality in the areas they address; however, they may have gaps relating to broader functionality requirements. Visionaries are thought leaders and innovators, but they may be lacking in scale or there may be concerns about their ability to grow and still provide consistent execution.

Summary of Visionaries Quadrant Positions

There are two main sets of vendors in the Visionaries quadrant, separated largely by their Ability to Execute. The first set of vendors provide a modern product offering backed by an established customer base, but have emerging or hampered momentum. The second set of vendors provide an innovative and potentially disruptive product vision, but either have gaps in their current offerings or a lack of visibility and traction in the current market (or a combination of both).

Niche Players

Niche Players do well in a specific segment of the BI and analytics platform market — such as cloud BI, customer-facing analytics, agile reporting and dashboarding, embeddability or big data integration — or have a limited capability to innovate or outperform other vendors. They may focus on a specific domain or aspect of BI, but are likely to lack depth of functionality elsewhere. They may also have gaps relating to broader platform functionality, or have less-than-stellar customer feedback. Alternatively, Niche Players may have a reasonably broad BI platform, but limited implementation and support capabilities or relatively limited customer bases (such as in a specific geography

or industry). In addition, they may not yet have achieved the necessary scale to solidify their market positions.

Summary of Niche Players Quadrant Positions

Half of the vendors in this Magic Quadrant are included in the Niche Players quadrant this year. All 12 vendors represented in the Niche Players quadrant have specialized strengths and differentiated capabilities that position them well to meet the rapidly evolving customer requirements of this market.

Context

Readers should not use this Magic Quadrant in isolation as a tool for vendor selection. This year, Gartner has dramatically modified and modernized the underlying BI and analytics platform definition in order to reflect the segment of the overall market where the majority of active net new buying is taking place. As a result of this change, historical comparison with Magic Quadrants from previous years (to assess vendor movement) is irrelevant and is strongly discouraged. Consider this Magic Quadrant to be more of a summary of Gartner's research on this market, with a particular focus on modern BI platforms. When making specific tool selection decisions, use it in combination with our Market Guide for traditional enterprise reporting platforms, Critical Capabilities, Survey Analysis research, and Strength, Weakness, Opportunity and Threat (SWOT) analysis publications, as well as our analyst inquiry service. Moreover, readers should be careful not to ascribe their own definitions of Completeness of Vision or Ability to Execute to this Magic Quadrant, which often map narrowly to product vision and market share, respectively. The Magic Quadrant methodology factors in a range of criteria in determining position, as defined in the extensive Evaluation Criteria section.

Market Overview

Overall, the BI and analytics market is expected to continue to grow 7.9% (adjusted for constant currency) through 2020 — as reflected in Gartner's current estimate of the compound annual growth rate for the sector (see "Forecast: Enterprise Software Markets, Worldwide, 2013-2020, 4Q16 Update"). The modern subsegment of the BI and analytics market segment continues to expand much more rapidly than the overall market — offsetting declines in traditional BI spending — but is expected to decelerate from 63.6% growth in 2015 to a projected 30% in 2016, and to further decelerate to 19% (in constant currency) by 2020. This expected lower rate of growth reflects the mainstreaming of a market that is growing in terms of seat expansion, but will be hampered by pricing pressure. Purchasing decisions continue to be heavily influenced by business executives and users who want more agility and the option for small personal and departmental deployments to prove success. This means that the land-and-expand model still dominates sales, but as enterprises expand deployments and enterprise readiness and enterprise-friendly buying models have become more critical to successful deployments, IT is now regaining some of its lost influence on the decision. The primary drivers of new growth in this rapidly evolving market are being influenced by the following dynamics:

- **Modern BI at scale will dominate new buying.** The increased need for governance at enterprise scale will serve as the catalyst for renewed IT engagement as business-user-led deployments expand. Business users initially flocked to the modern tools because they could use them without IT assistance — that was their main attraction. As deployments have grown over time, both in terms of number of users and in complexity of data and use cases, so IT must be more engaged with the business in order to develop agile processes that support the rapidly expanding universe of business-user-generated content and distributed content authors — to ensure responsible use and decisions based on trusted data and analysis. Modern BI tools that can support greater accessibility, agility and analytical insight while also maintaining ease of use (but at enterprise scale and trust for complex and large datasets) will drive and dominate new buying.
- **New and innovative vendors as well as established vendors will drive the next wave of market disruption that has begun.** As the once-disruptive visual-based exploration experience becomes mainstream and widely available, from large and small vendors alike, the market is on the cusp of the next disruptive wave, which will drive a new surge of buying — because of its potential value to reduce time to insights from advanced analytics and deliver them to a broader set of people across the enterprise. Smart data discovery capabilities automatically find hidden patterns in large, complex and increasingly multistructured datasets, without building models or writing algorithms or queries. It reduces the manual and bias-prone nature of the current visual-based exploration paradigm by highlighting, visualizing and narrating important findings, correlations, clusters, predictions, outliers, anomalies, linkages or trends in data that are relevant to the user without build models themselves. The ability to query and explore through natural language and embedding actionable insights in applications will also expand usage and value from analytics. Smart data discovery complements data science platforms by automated exploration and feature selection that can be further explored and validated by specialist data scientists. While this wave is in part driven by new innovative startups, traditional BI vendors that were slow to adjust to the current "modern wave of disruption" have been early to respond this time and are in some cases (such as IBM and Salesforce) driving the next "smart" wave.
- **The need for complex datasets drives investments in data preparation.** Business users want to analyze a diversity of often large and complex combinations of data sources and data models, beyond the data warehouse and data lake and including streaming data, faster than ever before. The ability to rapidly prepare, clean, enrich and find trusted, multistructured datasets becomes an important enabler of expanded use.
- **Extensibility and embeddability will be key drivers of expanded use and value.** Organizations can expand use through either offering business people, both internal users and customers, more automated tools or by embedding analytics in the applications they use — or some combination of both. The ability to embed and extend analytics content in

the user context will be a key enabler of more pervasive adoption of, and value from, analytics.

- **Supporting real-time events and streaming data and analysis will expand use cases.** Organizations will increasingly want to leverage the streaming data generated by devices, sensors and people in a connected world in order to make faster decisions. The players in the BI and analytics market will need to invest in similar capabilities — in order to offer buyers a single platform on which to combine real-time events and streaming data with other types of source data, and to develop a new breed of high-impact analytic applications that leverage the power of real-time actionable insight.
- **Marketplaces for content, data and algorithms will expand and mature, creating new opportunities for organizations to buy and sell analytic capabilities and speed time to insight.** The availability of active marketplaces where buyers and sellers converge to exchange analytic applications, curated data sources, custom visualizations and algorithms are likely to grow in the BI and analytics space and contribute to its future growth. An established marketplace also provides BI vendors with a new channel — where solutions built on top of their platforms can be sold into their customer channel or partner networks. The main beneficiary of a mature marketplace is the end-user organization, which will gain access to a virtually limitless array of capabilities that can be leveraged in their own internally developed solutions and processes.
- **Interest in cloud deployments will continue to grow.** Cloud deployments have the potential to reduce cost of ownership and speed the time to deployment; however, the "data gravity" that still tilts toward the majority of enterprise data residing on-premises has been, and continues to be, a major inhibitor to adoption — particularly with IT buyers. That reticence is slowly abating. In 2016, 46% of all reference survey customers said they either have deployed or were planning to deploy their BI and analytics platform in the cloud, with line-of-business respondents expressing much higher cloud intentions than IT respondents. In 2017, that proportion has increased to 51%, with the largest percentage increase in intention coming from IT respondents. We expect this trend to continue, with the majority of new license buying (more than half) likely to be for cloud deployments by 2020.
- **With the next wave of market disruption, new and innovative vendors will continue to emerge, but this change should be considered as part of an overall strategy.** During the next several years, buyers will benefit from significant market investment in innovation from large vendors as well as from venture capital investment in innovative startups. The downside of having a plethora of innovative products to pilot, and vendors to engage in proofs of concept (POCs) with, is the tendency for organizations to incur technical debt over time — as multiple stand-alone solutions that demonstrate business value quickly (and often hastily) turn into production deployments without adequate attention being paid to design, implementation and support. In this rapidly evolving BI market, organizations should be careful to limit

their technical debt, by developing a formal strategy and reference architecture to work within when evaluating their options; thus avoiding major rework and redesign efforts in the future.

Appendix

Other Modern BI and Analytics Platform Vendors

A number of interesting vendors participated in the Magic Quadrant process (with most identifying reference customers and providing information), but did not meet all of the criteria for inclusion in the Magic Quadrant. These vendors fall into the following categories:

- Embedded
- Graph-based data discovery
- Search-based data discovery
- Smart data discovery and natural-language generation (NLG)
- Streaming
- Other modern BI platform vendors

Specific vendors and products (where applicable) are listed below (see Table 3). These vendors will feature in forthcoming research.

Table 3. Other Relevant Vendors

Category	Vendor (Product)	Headquarters
Embedded	Exago BI	Shelton, Connecticut
Embedded	GoodData	San Francisco, California, U.S.
Embedded	Izenda (Izenda 7 Series)	Atlanta, Georgia, U.S.
Embedded	Jinfony (JReport)	Rockville, Maryland
Graph-Based Data Discovery	Centrifuge Systems	McLean, Virginia, U.S.
Graph-Based Data Discovery	Emcien	McLean, Virginia, U.S.
Graph-Based Data Discovery	Maana	Palo Alto, California
Graph-Based Data Discovery	SynerScope (Marcato 4.0 and Legato 2.0)	Helvoirt, Netherlands

Table 3. Other Relevant Vendors

Category	Vendor (Product)	Headquarters
Other Modern	Advisor Solutions	Downers Grove, Illinois, U.S.
Other Modern	AFS Technologies	Phoenix, Arizona, U.S.
Other Modern	Amazon Web Services (Amazon QuickSight)	Seattle, Washington, U.S.
Other Modern	Antivia (DecisionPoint)	Leeds, U.K.
Other Modern	Arcadia Data	San Mateo, California, U.S.
Other Modern	Bitam	Tampico, Tamaulipas, Mexico
Other Modern	Carto (Builder and Engine)	New York, U.S.
Other Modern	Chartio	San Francisco, California, U.S.
Other Modern	Dundas Data Visualization (Dundas BI)	Toronto, Ontario, Canada
Other Modern	Google (Google Data Studio [Beta])	Santa Clara, California, U.S.
Other Modern	Gridsum (Web Dissector)	Beijing, China
Other Modern	Halo BI	San Diego, California, U.S.
Other Modern	InetSoft	Piscataway, New Jersey, U.S.
Other Modern	Kofax (Kofax Insight)	Irvine, California, U.S.
Other Modern	Looker	Santa Cruz, California, U.S.
Other Modern	Manthan (Manthan Analytics Platform)	Bengaluru, Karnataka, India

Table 3. Other Relevant Vendors

Category	Vendor (Product)	Headquarters
Other Modern	OpenText (Analytics Suite)	Waterloo, Ontario, C
Other Modern	Panorama	Toronto, Ontario, C
Other Modern	Phocas	Coventry, U.K.
Other Modern	Salient	Horseheads, New Y
Other Modern	solidThinking (Envision); owned by Altair	Troy, Michigan, U.S.
Other Modern	Targit (Decision Suite 2017)	Hjørring, Denmark
Other Modern	WingArc 1st	Shibuya, Tokyo
Other Modern	Zendesk (Zendesk Explore)	San Francisco, Calif U.S.
Search-Based Data Discovery	AnswerRocket	Atlanta, Georgia, U.
Search-Based Data Discovery	Attivio	Newton, Massachus
Search-Based Data Discovery	Connexica	Stafford, U.K.
Search-Based Data Discovery	Drastin	Sunnyvale, Californ
Search-Based Data Discovery	Incorta	San Mateo, Californ
Search-Based Data Discovery	Smartlogic (Semaphore)	San Jose, California
Search-Based Data Discovery	Wizdee	Coimbra, Portugal

Table 3. Other Relevant Vendors

Category	Vendor (Product)	Headquarters
Smart Data Discovery and NLG	Automated Insights (Wordsmith)	Durham, North Carolina, U.S.
Smart Data Discovery	Ayasdi	Menlo Park, California, U.S.
Smart Data Discovery	Cambridge Semantics	Boston, Massachusetts, U.S.
Smart Data Discovery	DataRPM (Cognitive Predictive Maintenance Platform)	Redwood City, California, U.S.
Smart Data Discovery	Fractal Analytics (Cuddle.ai)	Jersey City, New Jersey, U.S.
Smart Data Discovery	Graphiq	Santa Barbara, California, U.S.
Smart Data Discovery and NLG	Narrative Science	Chicago, Illinois, U.S.
Smart Data Discovery	Nutonian	Boston, Massachusetts, U.S.
Smart Data Discovery and NLG	Yseop (Yseop Compose)	New York, U.S.
Streaming	Datawatch	Bedford, Massachusetts, U.S.
Streaming	Fusionex	London, U.K.
Streaming	Splunk	San Francisco, California, U.S.

Source: Gartner (February 2017)

Acronym Key and Glossary Terms

ACV	annual contract value
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AI	artificial intelligence
AWS	Amazon Web Services
BI	business intelligence
CPM	corporate performance management
ETL	extraction, transformation and loading
HDFS	Hadoop Distributed File System
IoT	Internet of Things
KPI	key performance indicator
NLG	natural-language generation
NLP	natural-language processing
NLQ	natural-language query
SDK	software development kit
SOR	system of record
TCO	total cost of ownership

Evidence

Gartner defines total software revenue as revenue that is generated from appliances, new licenses, updates, subscriptions and hosting, technical support and maintenance. Professional services are not included in total software revenue (see "Market Share Analysis: Business Intelligence and Analytics Software, 2015"). Gartner's analysis and the ratings and commentary in this

report are based on a number of sources: customers' perceptions of each vendor's strengths and challenges (as gleaned from their BI-related inquiries to Gartner); an online survey of vendors' reference customers (which was conducted during October 2016 and yielded 1,931 responses); a questionnaire completed by the vendors; vendors' briefings (including product demonstrations, strategy and operations); an extensive RFP questionnaire inquiring about how each vendor delivers the specific features that make up our 15 critical capabilities (see "Toolkit: BI and Analytics Platform RFP"); a prepared video demonstration of how well vendor BI platforms address specific functionality requirements across the 15 critical capabilities; and access to evaluation software from each vendor.

Note 1 Customer Survey Metrics Referenced in This Report

Magic Quadrant customer survey composite success measures are referenced throughout the report. Reference customer survey participants scored vendors on each metric; these metrics were calculated as follows:

- **Customer Experience:** This is a combined score consisting of ratings for achievement of business benefits, availability of skills and user enablement (which includes scores for training, online videos, online communities and documentation), and is based entirely on survey reference responses.
- **Operations:** This is a combined score consisting of rating for product quality, support and ease of migration and is based entirely on survey reference responses.
- **Sales Experience:** Customers rate their satisfaction with presales, contracting, pricing and account management.
- **Market Understanding:** This is a composite measure of ease of use for consumers, ease of use for developers, visual appeal, and ease of use for administration and deployment; and complexity of analysis (described below). We believe these two measures map to current buying requirements.
- **Complexity of Analysis:** This is a combined score consisting of an analyst opinion rating of how well the platform handles complex data needs, and a survey-based weighted average score based on the score for percentage of respondents reporting use of the platform for the types of analysis users conduct with the platform; more interactive and advanced types of analysis result in a higher score than static or parameterized reporting. Activities are weighted as follows:
 - Viewing static reports = 1
 - Using parameterized reports and dashboards = 1
 - Performing simple ad hoc analysis = 3

- Using predictive analytics and/or data mining models = 3
- Interactive exploration and analysis of data = 4
- Performing moderately complex to complex ad hoc analysis = 5
- Data integration and preparation = 5
- Analysts' opinion of how well the platform handles complex data needs were also evaluated, based on an assessment of:
 - Diversity of data source connectivity
 - Ability to combine multiple data sources
 - Support for streaming data
 - Multipass SQL capabilities
 - Ability to federate data
- **User Enablement:** This is a composite score consisting of individual ratings for documentation, online tutorials for content authors, online tutorials for consumers, online communities, training, availability of skills and user conferences.
- **Business Benefits:** The business benefits score is a score average taken from 10 different benefit areas, as follows:
 - Increased revenue
 - Better, faster decisions
 - Improved customer satisfaction
 - Reduce IT head count
 - Reduce external IT costs
 - Reduce non-IT costs
 - Expand types of analysis
 - Make better insights available to more people
 - Link KPIs to corporate objectives
 - Monetize data

Note 2 Change in Critical Capabilities From Last Year

Critical Capabilities Dropped or Changed:

- Combined BI Platform Administration with Security and User Administration

- Modified Data Source Connectivity to Data Source Connectivity and Ingestion
- Combined Publish Analytics Content and Collaboration and Social BI to Publish, Share and Collaborate on Analytic Content
- Added Visual Appeal to Ease of Use

Capabilities Added:

- Smart Data Discovery
- Platform Capabilities Workflow Integration

Note Detailed Subcriteria

3

Infrastructure

- **BI Platform Administration, Security and Architecture:** Capabilities that enable platform security, administering users, auditing platform access and utilization, optimizing performance and ensuring high availability and disaster recovery:
 - Authentication
 - Authorization
 - User Administration
 - Application Support
 - Auditing
 - Usage Monitoring
 - Vulnerability
 - Encryption
 - Architecture
 - High Availability and Disaster Recovery
 - Scalability and Performance
- **Cloud BI:** Platform as a service and analytic application as a service capabilities for building, deploying and managing analytics and analytic applications in the cloud based on data both in the cloud and on-premises:
 - Direct Connect for both Cloud and On-Premises Data Sources (Hybrid)
 - Cloud Data Storage
 - Packaged Content
 - Self-Service Administration

- Cloud Authoring
- Self-Service Elasticity
- Marketplace
- Multitenancy
- **Data Source Connectivity and Ingestion:** Capabilities that allow users to connect to structured and unstructured data contained within various types of storage platforms, both on-premises and in the cloud:
 - OLAP Connectivity
 - Personal and Web Data
 - Unstructured and Semistructured Data
 - Out-of-the-Box Enterprise Application Connectivity Both Cloud and On-Premises
 - Relational Query Access
 - Hadoop/NoSQL Sources

Data Management

- **Metadata Management:** Tools for enabling users to leverage the same system-of-record semantic model and metadata. They should provide a robust and centralized way for administrators to search, capture, store, reuse and publish metadata objects such as dimensions, hierarchies, measures, performance metrics/key performance indicators (KPIs), and report layout objects, parameters and so on. Administrators should have the ability to promote a business-user-defined data mashup and metadata to the system-of-record metadata:
 - Data Lineage and Impact Analysis
 - Data Modeling
 - Metadata Layer Capabilities
- **Self-Contained ETL and Data Storage:** Platform capabilities for accessing, integrating, transforming and loading data into a self-contained storage layer with the ability to index data, manage data loads and refresh scheduling:
 - Built-In Data Integration Capabilities
 - Built-In Data Storage Capabilities
 - In-Database Processing
 - Search or NLP Index Management
 - Data Loading
 - Load Scheduling and Monitoring
- **Self-Service Data Preparation:** "Drag and drop" user-driven data combination of different sources and the creation of analytic models such

as user-defined measures, sets, groups and hierarchies. Advanced capabilities include semantic autodiscovery, intelligent joins, intelligent profiling, hierarchy generation and data lineage and data blending on varied data sources, including multistructured data:

- Business User Data Lineage
- Business User Data Mashup and Modeling
- Business User Joins
- Business User Data Inference
- Business User Data Enrichment
- Watermarks
- Business User Data Masking
- Promotability
- Reuse
- Business User Data Profiling

Analysis and Content Creation

- **Embedded Advanced Analytics:** Enables users to easily access advanced analytics capabilities that are self-contained within the platform itself or through the import and integration of externally developed models:
 - Advanced Algorithms
 - Analytical Functions
 - Open Standards
 - Real-Time Scoring
 - Statistical Functions
- **Analytic Dashboards:** The ability to create highly interactive dashboards and content, with visual exploration and embedded advanced and geospatial analytics, to be consumed by others:
 - Search-Based Discovery
 - Content Authoring
 - Chart Types Supported for Design
 - Chart Formatting Options
 - Consistent Chart Types and Interactivity
 - Ability to Display Very Large Datasets
 - Animation and Playback
 - Disconnected Exploration
 - Mapping and Auto-Geocoding

- Out-of-the-Box Distance Calculations for Location Intelligence
- Formatting and Layout
- Reusable Dashboard Templates
- **Interactive Visual Exploration:** Enables the exploration of data via the manipulation of chart images, with the color, brightness, size, shape and motion of visual objects representing aspects of the dataset being analyzed. This includes an array of visualization options that go beyond those of pie, bar and line charts, including heat and tree maps, geographic maps, scatter plots and other special-purpose visuals. These tools enable users to analyze the data by interacting directly with a visual representation of it:
 - Consumer Interactivity and Exploration
 - Custom Groupings
 - Global Filters
 - Bins
 - Chart Types Supported for Analysis
 - Display as Percentages
 - Visualizations Linking
 - Conditional Formatting
 - Information Visualizations
 - Natural-Language Q&A
 - Automatic Chart Selection and Optimal Display
 - Tutorials and Online Information
- **Smart Data Discovery:** Automatically finds, visualizes and narrates important findings such as correlations, exceptions, clusters, links and predictions in data that are relevant to users without requiring them to build models or write algorithms. Users explore data via visualizations, natural-language-generated narration, search and natural-language query technologies:
 - Automatic Advanced Analytics Visualizations
 - Automatic Insight Generation
 - Open Models
 - Natural-Language Generation
 - Operationalizing Models
- **Mobile Exploration and Authoring:** Enables organizations to develop and deliver content to mobile devices in a publishing and/or interactive mode, and takes advantage of mobile devices' native capabilities such as touchscreen, camera, location awareness and natural-language query:

- Touchscreen Experience
- Mobile Device Support
- Device-Based Security
- Offline Exploration
- Interactive Manipulation
- Responsive Design
- Mobile Content Creation
- GPS Integration

Share Findings

- **Embed Analytic Content:** Capabilities including a software developer's kit with APIs and support for open standards for creating and modifying analytic content, visualizations and applications, embedding them into a business process, and/or an application or portal. These capabilities can reside outside the application, reusing the analytic infrastructure, but must be easily and seamlessly accessible from inside the application without forcing users to switch between systems. The capabilities for integrating BI and analytics with the application architecture will enable users to choose where in the business process the analytics should be embedded:
 - SDK for Printing and Parameterization
 - SDK Create, Copy and Delete Capabilities
 - Security SDK Capabilities
 - SDK for Building Workflow
 - SDK for Building Connectors
 - SDK for Custom Visualizations/Analytic Web Applications
 - SDK for Administration
 - SDK Data Load Capabilities
 - White-Labeling
 - Portal Integration
 - Embeddability/Extensibility
- **Publish, Share and Collaborate on Analytic Content:** Capabilities that allow users to publish, deploy and operationalize analytic content through various output types and distribution methods with support for content search, scheduling and alerts. Enables users to share and discuss information, analysis, analytic content and decisions via discussion threads, chat and annotations:
 - Output Format
 - Content Search

- Infographics
- Scheduling
- Event-Based Scheduling
- Conditional Alerts
- Mobile Distribution
- Printing
- Content Posting
- Storytelling
- Discussion Threads
- Integration with Social Platforms
- Real-Time Collaboration
- Mobile Collaboration
- Timelines
- Rating and Recommendations

User Experience

- **Platform Capabilities Workflow Integration:** How many products are needed to deliver the critical capabilities and the degree of seamless integration and workflow between capabilities/components.
- **Ease of Use and Visual Appeal:** Overall platform ease of use to install, administer and manage the platform and create and consume analytic content:
 - Ease of Use for Consumers
 - Ease of Use for Content Authors
 - Ease of Use to Implement and Administer the Platform
 - Visual Appeal

Evaluation Criteria Definitions

Ability to Execute

Product/Service: Core goods and services offered by the vendor for the defined market. This includes current product/service capabilities, quality, feature sets, skills and so on, whether offered natively or through OEM agreements/partnerships as defined in the market definition and detailed in the subcriteria.

Overall Viability: Viability includes an assessment of the overall organization's financial health, the financial and practical success of the business unit, and the likelihood that the individual business unit will continue investing in the product,

will continue offering the product and will advance the state of the art within the organization's portfolio of products.

Sales Execution/Pricing: The vendor's capabilities in all presales activities and the structure that supports them. This includes deal management, pricing and negotiation, presales support, and the overall effectiveness of the sales channel.

Market Responsiveness/Record: Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the vendor's history of responsiveness.

Marketing Execution: The clarity, quality, creativity and efficacy of programs designed to deliver the organization's message to influence the market, promote the brand and business, increase awareness of the products, and establish a positive identification with the product/brand and organization in the minds of buyers. This "mind share" can be driven by a combination of publicity, promotional initiatives, thought leadership, word of mouth and sales activities.

Customer Experience: Relationships, products and services/programs that enable clients to be successful with the products evaluated. Specifically, this includes the ways customers receive technical support or account support. This can also include ancillary tools, customer support programs (and the quality thereof), availability of user groups, service-level agreements and so on.

Operations: The ability of the organization to meet its goals and commitments. Factors include the quality of the organizational structure, including skills, experiences, programs, systems and other vehicles that enable the organization to operate effectively and efficiently on an ongoing basis.

Completeness of Vision

Market Understanding: Ability of the vendor to understand buyers' wants and needs and to translate those into products and services. Vendors that show the highest degree of vision listen to and understand buyers' wants and needs, and can shape or enhance those with their added vision.

Marketing Strategy: A clear, differentiated set of messages consistently communicated throughout the organization and externalized through the website, advertising, customer programs and positioning statements.

Sales Strategy: The strategy for selling products that uses the appropriate network of direct and indirect sales, marketing, service, and communication affiliates that extend the scope and depth of market reach, skills, expertise, technologies, services and the customer base.

Offering (Product) Strategy: The vendor's approach to product development and delivery that emphasizes differentiation, functionality, methodology and feature sets as they map to current and future requirements.

Business Model: The soundness and logic of the vendor's underlying business proposition.

Vertical/Industry Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of individual market segments, including vertical markets.

Innovation: Direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes.

Geographic Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries as appropriate for that geography and market.



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Llistat d'apartats que són massa extensos per incloure dins la memòria i tenen un caràcter autocontingut (per exemple, manuals d'usuari, manuals d'instal·lació, etc.)

Depenent del tipus de treball, és possible que no calgui afegir cap annex.