

## Comparison table

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### References

#	Authors	Compared article	Complementary article
1	Jovanovic et al.	[16]	[15]
2	Khoury et al	[18]	[2]
3	Krneta et al.	[20]	-
4	Maté and Trujillo	[28]	[29]
5	Moreira et al.	[33]	-
6	Neil et al.	[38]	-
7	Cravero Leal et al	[7]	-
8	Hachaichi and Feki	[11]	-
9	Thenmozhi and Vivekanandan	[51]	[50]
10	de Mul et al.	[34]	-
11	Di Tria et al.	[52]	[30]
12	Khoury et al.	[19]	[3]
13	Nebot and Berlanga	[36]	[37]
14	Hu et al.	[12]	-
15	Romero et al.	[43]	[48]
16	Zekri et al.	[54]	-
17	Burney et al.	[5]	-
18	Chute et al.	[6]	-
19	Nazri et al.	[35]	-
20	Romero and Abelló	[41]	[42]
21	Rönnbäck et al.	[44]	-

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<b>22</b>	Zepeda et al.	[55]	[32]
<b>23</b>	Lin et al.	[22]	-
<b>24</b>	Lowe et al.	[23]	-
<b>25</b>	Branson et al.	[4]	-
<b>26</b>	Giorgini et al.	[8]	[9]
<b>27</b>	Rubin and Desser	[45]	-
<b>28</b>	Mazon et al.	[31]	[21]
<b>29</b>	Sahama and Croll	[46]	-
<b>30</b>	Song et al.	[49]	-
<b>31</b>	Lujan-Mora and Trujillo	[24]	-
<b>32</b>	Malinowski and Zimányi	[26]	[25]
<b>33</b>	Prat et al.	[40]	-
<b>34</b>	Sitompul and Noah	[47]	[9]
<b>35</b>	Jensen et al.	[14]	-
<b>36</b>	Abelló and Martín	[1]	[27]
<b>37</b>	Wisniewski et al.	[53]	-
<b>38</b>	Phipps and Davis	[39]	[10]
<b>39</b>	Kerkri et al.	[17]	-
<b>40</b>	Husemann et al.	[13]	-

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P#	Year	D. App.	P-CRE	P-MAP	P-ETL	P-KEV	P-REV	P-SEV	K. Rep.	R. Rep.	S. Rep.	S Ana.	Multi. S.	Algo.
[16]	14	R	mg	ma			mg	ma	OM	Tagged Graph	none	No	Yes	Yes
[18]	14	R	ma	ma					OM	OM	none	??	No	inc.
[20]	14	S	pg	??					none	none	RDT	S	Yes	Yes
[28]	14	R-S	pg	xx			??	??	none	MD-UML	CWM	S	No	No
[33]	14	K-R-S	pg	xx					OM	Text	??	S	No	No
[38]	14	S	mg						none	??	ERM	S	No	No
[7]	13	R	xx						none	BMM	??	??	??	No
[11]	13	S	mg		ma				none	none	ODMG	S	No	Yes
[51]	13	R-S	pg	ma					none	OM	OM	S	No	Yes
[34]	12	R	xx		??				none	Text	??	??	No	No
[52]	12	R-S	pg	mg					OM	MD-UML	exDFM	S	??	Yes
[19]	12	R-S	ma	ma	??	??	??	??	OM	Goal Model	none	No	Yes	inc.
[36]	12	K-R	pg	pa	pa				OM	DL Exp.	??	No	Yes	Yes
[12]	11	K-S	xx		??				OM	none	EAV	No	??	n/a
[43]	11	R-S	mg	ma	pg				none	i* model	OM	S	??	Yes
[54]	11	S	pa						none	Graph	Graph	S	No	No
[5]	10	K	n/a						OM	DFD	??	??	??	No
[6]	10	K-R-S	??						OM	??	??	??	??	No
[35]	10	S	xx	ma					OM	none	RDT	S	No	inc.
[41]	10	S	mg						OM	Math. Exp.	none	??	No	inc.
[44]	10	R	pg				pg		none	??	??	No	No	No
[55]	10	R-S	pa	??					none	goalModel	RDT	S	No	No
[22]	09	R	xx						none	Text	??	??	No	No
[23]	09	?	??						OM	??	??	??	No	No
[4]	08	K-S	xx						OM	??	??	??	No	No
[8]	08	R-S	pg	??					none	i* model	RDT	??	??	No
[45]	08	K-S	xx						none	none	Excel .cvs	S	No	No
[31]	07	R-S	pg	pg					none	MD-UML	CWM	S	No	No
[46]	07	R	xx	xx	xx				none	Text	Report	n/a	?	No
[49]	07	R-S	pg						none	??	??	S	No	Yes
[24]	06	R-S	xx	pg	xx				none	UML	UML	??	No	No
[26]	06	R-S	xx						none	MultiDimERM	??	??	??	No
[40]	06	R	pg	pg					none	UML	??	??	No	inc.
[47]	06	S	pg						??	none	??	S	No	No
[14]	04	S	ma						none	??	RDT	S	No	Yes
[1]	03	S	pg		pg				none	??	RDT	S	Yes	No
[53]	03	S	xx	xx					none	none	RDT	??	No	No
[39]	02	R-S	pg						none	MDX	ERM	S	No	Yes
[17]	01	S	??	??					??	??	RDT	Yes	No	No
[13]	00	R	xx						none	??	ERM	S	No	No

#P	Year	CDM	LDM	PDM	TDM	DW type	Case	Data set	Nb. S.	Nb. Rel.	Nb. Att.	Nb. Tup.
[16]	14	No	Tagged Graph	No	No	DM	Yes	LEARN-SQL	3	16	?	?
[18]	14	OM	RDT	OBDW	No	DM	Yes	LUBM	n/a	n/a	n/a	n/a
[20]	14	No	Data Vault	SQL	No	Data Vault	Yes	Ad Hoc	1	8	44	>1M
[28]	14	MD-UML	No	No	No	DM	Yes	Ad Hoc	1	>100	??	??
[33]	14	??	No	No	Ad Hoc	DM	Yes	Ad Hoc	??	??	??	??
[38]	14	TAG	RDT	SQL	Ad Hoc	RDT	Yes	Ad Hoc	1	4	7	??
[7]	13	MD-UML	No	No	No	DM	Yes	Ad Hoc	??	??	??	??
[11]	13	DFM	No	No	No	DM	Yes	Ad Hoc	4	??	??	??
[51]	13	OM	Star	No	No	DM	Yes	EU-Car	n/a	n/a	n/a	n/a
[34]	12	ERM	RDT	SQL	No	DM	RC	n/a	??	??	??	??
[52]	12	exDFM	RDT	No	No	DM	Yes	Ad Hoc	1	8	28	??
[19]	12	OM	Star	OBDW	No	DM	Yes	EU-Car	n/a	n/a	n/a	n/a
[36]	12	No	No	RDF	No	DM	RC	n/a	1	??	??	??
[12]	11	OM	No	RDF	Ad Hoc	EAV	Yes	Ad Hoc	1	??	??	>5000
[43]	11	??	No	No	No	DM	Yes	TPC-DS	??	28	??	??
[54]	11	No	Star	No	No	DM	Yes	Ad Hoc	1	16	??	??
[5]	10	TempR	RDT	No	TempR	RDT	Yes	Ad Hoc	??	??	??	??
[6]	10	??	??	SQL	Yes	RDT	RC	n/a	??	??	??	??
[35]	10	ME/R	No	No	No	DM	Yes	Ad Hoc	1	7	41	??
[41]	10	No	Constellation	No	No	DM	Yes	EU-Car	n/a	n/a	n/a	n/a
[44]	10	Anchor	No	SQL	TRM	Rel-Anchor	Yes	Ad Hoc	1	25	25	1M
[55]	10	No	Star	SQL	No	DM	No	n/a	n/a	n/a	n/a	n/a
[22]	09	ERM	??	No	No	RDT	RC	n/a	??	??	??	??
[23]	09	??	UML-Class	RDF	No	??	inc.	Ad Hoc	??	??	??	??
[4]	08	??	No	No	No	??	RC	n/a	??	??	??	??
[8]	08	DFM	No	No	No	DM	RC	n/a	??	??	??	??
[45]	08	??	??	SQL	No	RDT	inc.	Ad Hoc	??	??	??	??
[31]	07	??	RDT	No	No	DM	inc.	Ad Hoc	??	6	22	??
[46]	07	??	??	??	No	??	RC	n/a	??	??	??	??
[49]	07	No	Star	No	No	DM	inc.	Ad Hoc	??	??	??	??
[24]	06	MD-UML	No	UML	No	DM	Yes	Ad Hoc	1	??	??	??
[26]	06	ERM	No	No	Ad Hoc	DM	Yes	Ad Hoc	1	3	15	??
[40]	06	UML	UMD	MOLAP	No	DM	Yes	Ad Hoc	1	20	28	??
[47]	06	DFM	No	No	No	DM	Yes	Ad Hoc	1	7	16	??
[14]	04	No	Snowflake	No	No	DM	No	Ad Hoc	n/a	n/a	n/a	n/a
[1]	03	No	No	??	Ad Hoc	RDT	No	n/a	n/a	n/a	n/a	n/a
[53]	03	??	??	SQL	No	RDT	RC	n/a	13	600	?	>32M
[39]	02	ME/R	No	No	No	DM	inc.	TPC-H	??	??	??	??
[17]	01	??	??	??	No	??	No	n/a	n/a	n/a	n/a	n/a
[13]	00	??	??	??	No	DM	inc.	Ad Hoc	1	6	18	??

## Caption

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<b>Annotations</b>	
<b>n/a</b>	non applicable
<b>pg</b>	partially automated with guidance required;
<b>pa</b>	partially automated (with or without parameterization);
<b>xx</b>	not significantly automated;
<b>mg</b>	mostly automated with guidance required;
<b>ma</b>	mostly automated (with or without parameterization);
<b>??</b>	information not explicit
<b>inc.</b>	incomplete description
<b>fg</b>	fully automated with guidance required;
<b>fa</b>	fully automated (with or without parameterization; guidance may be available but not required);

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<b>Criteria Acronyms</b>	
<b>P#</b>	Paper number
<b>D. App.</b>	Design Approach
<b>P-CRE</b>	Creation process
<b>P-MAP</b>	Mapping process
<b>P-ETL</b>	Extract-Load-Transform process
<b>P-KEV</b>	Knowledge evolution process
<b>P-REV</b>	Requirement evolution process
<b>P-SEV</b>	Source evolution process
<b>K. Rep.</b>	Knowledge representation
<b>R. Rep</b>	Requirement representation
<b>S. Rep.</b>	Source representation
<b>S. Ana.</b>	Source analysis
<b>Multi. S.</b>	Multiple source
<b>Algo.</b>	Algorithme
<b>CDM</b>	Conceptual design model
<b>LDM</b>	Logical design model
<b>PDM</b>	Physical design model
<b>TDM</b>	Temporal design model
<b>DW type</b>	Data warehouse type

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<b>Case</b>	Case study
<b>Nb. S.</b>	Case study Source count
<b>Nb. Rel.</b>	Case study Relation count
<b>Nb. Att.</b>	Case study Attribute count
<b>Nb. Tup.</b>	Case study Tuple count

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### Value Acronyms

<b>BMM</b>	Business Motivation Model
<b>CWM</b>	Common Warehouse Metamodel
<b>DFD</b>	Data Flow Diagram
<b>DL exp</b>	Description Logic expression
<b>DFM</b>	Dimensional Fact Model
<b>DM</b>	Dimensional Model
<b>EAV</b>	Entity-Attribute-Value
<b>ERM</b>	Entity-Relationship Model
<b>GEM</b>	Generating ETL and Multidimensional designs
<b>ME/R</b>	Multidimensional Entity-Relationship
<b>MDX</b>	Multidimensional Expressions (MDX queries)
<b>OCL</b>	Object Constraint Language (OMG)
<b>ODMG</b>	ODMG object data model
<b>OBDW</b>	OM based data warehouse
<b>OBDB</b>	OM-based Database
<b>OM</b>	Ontology Model
<b>RDT</b>	Relational Design Theory
<b>TAG</b>	Temporal Attribute Graph
<b>TMD</b>	Temporal Multidimensional Model
<b>TRM</b>	Temporal Relational Model
<b>MD-UML</b>	UML Profile for multidimensional modeling [Luján-Mora et al. 2006]
<b>UMD</b>	Unified Multidimensional Model

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### References

1. Abelló, A., Martín, C.: A Bitemporal Storage Structure for a Corporate Data Warehouse. *Proceedings of the 5th International Conference on Enterprise Information Systems*. pp. 177–183. (2003)
2. Bellatreche, L., Khouri, S., Berkani, N.: Semantic Data Warehouse Design: From ETL to Deployment à la Carte. In: Meng, W., Feng, L., Bressan, S., Winiwarter, W., and Song, W. (eds.) *Database Systems for Advanced Applications*. pp. 64–83. Springer Berlin Heidelberg (2013)
3. Berkani, N., Khouri, S., Bellatreche, L.: Generic Methodology for Semantic Data Warehouse Design: From Schema Definition to ETL. *4th International Conference on Intelligent Networking and Collaborative Systems (INCoS)*. pp. 404–411. IEEE Computer Society (2012)
4. Branson, A., Hauer, T., McClatchey, R., Rogulin, D., Shamdasani, J.: A data model for integrating heterogeneous medical data in the Health-e-Child project. *Stud. Health Technol. Inform.* 138, 13–23 (2008)
5. Burney, A., Mahmood, N., Ahsan, K.: TempR-PDM: A Conceptual Temporal Relational Model for Managing Patient Data. *Proceedings of the 9th International Conference on Artificial Intelligence, Knowledge Engineering and Data Bases*. pp. 237–243. World Scientific and Engineering Academy and Society (WSEAS), Stevens Point, Wisconsin, USA (2010)
6. Chute, C.G., Beck, S.A., Fisk, T.B., Mohr, D.N.: The Enterprise Data Trust at Mayo Clinic: a semantically integrated warehouse of biomedical data. *J. Am. Med. Inform. Assoc. JAMIA*. 17, 2, 131–135 (2010)
7. Cravero Leal, A., Mazón, J.N., Trujillo, J.: A business-oriented approach to data warehouse development. *Ing. E Investig.* 33, 1, 59–65 (2013)
8. Giorgini, P., Rizzi, S., Garzetti, M.: GRAnD: A goal-oriented approach to requirement analysis in data warehouses. *Decis. Support Syst.* 4–21 (2008)
9. Golfarelli, M., Maio, D., Rizzi, S.: Conceptual design of data warehouses from E/R schemes. *Proceedings of the Thirty-First Hawaii International Conference on System Sciences, 1998*. pp. 334–343 vol.7. (1998)
10. Golfarelli, M., Rizzi, S., Saltarelli, E.: WAND: A CASE Tool for Workload-Based Design of a Data Mart. *SEBD*. pp. 422–426. Citeseer (2002)
11. Hachaichi, Y., Feki, J.: An Automatic Method for the Design of Multidimensional Schemas From Object Oriented Databases. *Int. J. Inf. Technol. Decis. Mak.* 12, 6, 1223–1259 (2013)
12. Hu, H., Correll, M., Kvecher, L., Osmond, M., Clark, J., Bekhash, A., Schwab, G., Gao, D., Gao, J., Kubatin, V., Shriver, C.D., Hooke, J.A., Maxwell, L.G., Kovatich, A.J., Sheldon, J.G., Liebman, M.N., Mural, R.J.: DW4TR: A Data Warehouse for Translational Research. *J. Biomed. Inform.* 44, 6, 1004–1019 (2011)
13. Husemann, B., Lechtenbörger, J., Vossen, G.: Conceptual Data Warehouse Design. *Proceedings of the International Workshop on Design and Management of Data Warehouses, DMDW 2000*. pp. 3–9. (2000)
14. Jensen, M.R., Holmgren, T., Pedersen, T.B.: Discovering Multidimensional Structure in Relational Data. In: Kambayashi, Y., Mohania, M., and Wöß, W. (eds.) *Data Warehousing and Knowledge Discovery*. pp. 138–148. Springer Berlin Heidelberg (2004)

15. Jovanovic, P., Romero, O., Simitsis, A., Abelló, A., Candón, H., Nadal, S.: Quarry: Digging Up the Gems of Your Data Treasury. In: Alonso, G., Geerts, F., Popa, L., Barceló, P., Teubner, J., Ugarte, M., Bussche, J.V. den, and Paredaens, J. (eds.) *Proceedings of the 18th International Conference on Extending Database Technology, EDBT 2015, Brussels, Belgium, March 23-27, 2015*. pp. 549–552. OpenProceedings.org (2015)
16. Jovanovic, P., Romero, O., Simitsis, A., Abelló, A., Mayorova, D.: A requirement-driven approach to the design and evolution of data warehouses. *Inf. Syst.* 44, 94–119 (2014)
17. Kerkri, E.M., Quantin, C., Allaert, F.A., Cottin, Y., Charve, P., Jouanot, F., Yétongnon, K.: An Approach for Integrating Heterogeneous Information Sources in a Medical Data Warehouse. *J. Med. Syst.* 25, 3, 167–176 (2001)
18. Khouri, S., Bellatreche, L., Jean, S., Ait-Ameur, Y.: Requirements driven data warehouse design: We can go further. 6th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation, ISoLA 2014, October 8, 2014 - October 11, 2014. pp. 588–603. Springer Verlag (2014)
19. Khouri, S., Boukhari, I., Bellatreche, L., Sardet, E., Jean, S., Baron, M.: Ontology-based structured web data warehouses for sustainable interoperability: requirement modeling, design methodology and tool. *Comput. Ind.* 63, 8, 799–812 (2012)
20. Krneta, D., Jovanovic, V., Marjanovic, Z.: A direct approach to physical Data Vault design. *Comput. Sci. Inf. Syst.* 11, 2, 569–599 (2014)
21. Lechtenbörger, J., Vossen, G.: Multidimensional normal forms for data warehouse design. *Inf. Syst.* 28, 5, 415 – 434 (2003)
22. Lin, S.-H., Lee, Y.-C.G., Hsu, C.-Y.: Data Warehouse Approach to Build a Decision-Support Platform for Orthopedics Based on Clinical and Academic Requirements. In: Ślęzak, D., Arslan, T., Fang, W.-C., Song, X., and Kim, T. (eds.) *Bio-Science and Bio-Technology*. pp. 89–96. Springer Berlin Heidelberg (2009)
23. Lowe, H.J., Ferris, T.A., Hernandez, P.M., Weber, S.C.: STRIDE – An Integrated Standards-Based Translational Research Informatics Platform. *AMIA. Annu. Symp. Proc.* 2009, 391–395 (2009)
24. Lujan-Mora, S., Trujillo, J.: Applying the UML and the Unified Process to the design of Data Warehouses. *J. Comput. Inf. Syst.* 47, 5, 30–58 (2006)
25. Malinowski, E., Zimányi, E.: A conceptual model for temporal data warehouses and its transformation to the ER and the object-relational models. *Data Knowl. Eng.* 64, 1, 101–133 (2008)
26. Malinowski, E., Zimányi, E.: A Conceptual Solution for Representing Time in Data Warehouse Dimensions. *Proceedings of the 3rd Asia-Pacific Conference on Conceptual Modelling - Volume 53*. pp. 45–54. Australian Computer Society, Inc., Darlinghurst, Australia, Australia (2006)
27. Martin, C., Abelló, A.: A Temporal Study of Data Sources to Load a Corporate Data Warehouse. In: Kambayashi, Y., Mohania, M., and Wöß, W. (eds.) *Data Warehousing and Knowledge Discovery*. pp. 109–118. Springer Berlin Heidelberg (2003)



28. Maté, A., Trujillo, J.: Tracing conceptual models' evolution in data warehouses by using the model driven architecture. *Comput. Stand. Interfaces.* 36, 5, 831–843 (2014)
29. Mazón, J.-N., Pardillo, J., Trujillo, J.: A Model-Driven Goal-Oriented Requirement Engineering Approach for Data Warehouses. In: Hainaut, J.-L., Rundensteiner, E.A., Kirchberg, M., Bertolotto, M., Brochhausen, M., Chen, Y.-P.P., Cherfi, S.S.-S., Doerr, M., Han, H., Hartmann, S., Parsons, J., Poels, G., Rolland, C., Trujillo, J., Yu, E., and Zimányie, E. (eds.) *Advances in Conceptual Modeling – Foundations and Applications.* pp. 255–264. Springer Berlin Heidelberg (2007)
30. Mazón, J.-N., Trujillo, J.: A Hybrid Model Driven Development Framework for the Multidimensional Modeling of Data Warehouses. *SIGMOD Rec.* 38, 2, 12–17 (2009)
31. Mazón, J.-N., Trujillo, J., Lechtenbörger, J.: Reconciling requirement-driven data warehouses with data sources via multidimensional normal forms. *Data Knowl. Eng.* 63, 3, 725–751 (2007)
32. Mazon, J.-N., Trujillo, J., Serrano, M., Piattini, M.: Applying MDA to the Development of Data Warehouses. *Proceedings of the 8th ACM International Workshop on Data Warehousing and OLAP.* pp. 57–66. ACM, New York, NY, USA (2005)
33. Moreira, J., Cordeiro, K., Campos, M.L., Borges, M.: OntoWarehousing – Multidimensional Design Supported by a Foundational Ontology: A Temporal Perspective. In: Bellatreche, L. and Mohania, M.K. (eds.) *Data Warehousing and Knowledge Discovery.* pp. 35–44. Springer International Publishing (2014)
34. De Mul, M., Alons, P., van der Velde, P., Konings, I., Bakker, J., Hazelzet, J.: Development of a clinical data warehouse from an intensive care clinical information system. *Comput. Methods Programs Biomed.* 105, 1, 22–30 (2012)
35. Nazri, M.N.M., Noah, S.A., Hamid, Z.: Using Lexical Ontology for Semi-automatic Logical Data Warehouse Design. In: Yu, J., Greco, S., Lingras, P., Wang, G., and Skowron, A. (eds.) *Rough Set and Knowledge Technology.* pp. 257–264. Springer Berlin Heidelberg (2010)
36. Nebot, V., Berlanga, R.: Building data warehouses with semantic web data. *Decis. Support Syst.* 52, 4, 853–868 (2012)
37. Nebot, V., Berlanga, R., Pérez, J.M., Aramburu, M.J., Pedersen, T.B.: Multidimensional Integrated Ontologies: A Framework for Designing Semantic Data Warehouses. In: Spaccapietra, S., Zimányi, E., and Song, I.-Y. (eds.) *Journal on Data Semantics XIII.* pp. 1–36. Springer Berlin Heidelberg (2009)
38. Neil, C.G., De Vincenzi, M.E., Pons, C.F.: Design method for a Historical Data Warehouse, explicit valid time in multidimensional models. *Ingeniare Rev. Chil. Ing.* 22, 2, 218–232 (2014)
39. Phipps, C., Davis, K.C.: Automating Data Warehouse Conceptual Schema Design and Evaluation. *Design and Management of Data Warehouses.* pp. 23–32. Citeseer (2002)

40. Prat, N., Akoka, J., Comyn-Wattiau, I.: A UML-based data warehouse design method. *Decis. Support Syst.* 42, 3, 1449–1473 (2006)
41. Romero, O., Abelló, A.: A framework for multidimensional design of data warehouses from ontologies. *Data Knowl. Eng.* 69, 11, 1138–1157 (2010)
42. Romero, O., Abelló, A.: Automatic validation of requirements to support multidimensional design. *Data Knowl. Eng.* 69, 9, 917–942 (2010)
43. Romero, O., Simitsis, A., Abelló, A.: GEM: Requirement-Driven Generation of ETL and Multidimensional Conceptual Designs. In: Cuzzocrea, A. and Dayal, U. (eds.) *Data Warehousing and Knowledge Discovery*. pp. 80–95. Springer Berlin Heidelberg (2011)
44. Rönnbäck, L., Regardt, O., Bergholtz, M., Johannesson, P., Wohed, P.: Anchor modeling — Agile information modeling in evolving data environments. *Data Knowl. Eng.* 69, 12, 1229–1253 (2010)
45. Rubin, D.L., Desser, T.S.: A Data Warehouse for Integrating Radiologic and Pathologic Data. *J. Am. Coll. Radiol.* 5, 3, 210–217 (2008)
46. Sahama, T.R., Croll, P.R.: A Data Warehouse Architecture for Clinical Data Warehousing. *Proceedings of the 5th Australasian Symposium on ACSW Frontiers*. pp. 227–232. Australian Computer Society, Inc., Darlinghurst, Australia, Australia (2007)
47. Sitompul, O.S., Noah, S.A.: A Transformation-oriented Methodology to Knowledge-based Conceptual Data Warehouse Design. *J. Comput. Sci.* 2, 5, 460–465 (2006)
48. Skoutas, D., Simitsis, A.: Ontology-Based Conceptual Design of ETL Processes for Both Structured and Semi-Structured Data: *Int. J. Semantic Web Inf. Syst.* 3, 4, 1–24 (2007)
49. Song, I.Y., Khare, R., Dai, B.: SAMSTAR: a semi-automated lexical method for generating star schemas from an entity-relationship diagram. *Proceedings of the ACM tenth international workshop on Data warehousing and OLAP*. pp. 9–16. ACM (2007)
50. Thenmozhi, M., Vivekanandan, K.: An ontology based hybrid approach to derive multidimensional schema for data warehouse. *Int. J. Comput. Appl.* 54, 8, 36–42 (2012)
51. Thenmozhi, M., Vivekanandan, K.: A Tool for Data Warehouse Multidimensional Schema Design using Ontology. *Int. J. Comput. Sci. Issues IJCSI*. 10, 2, 161–168 (2013)
52. Di Tria, F., Lefons, E., Tangorra, F.: Hybrid methodology for data warehouse conceptual design by UML schemas. *Inf. Softw. Technol.* 54, 4, 360–379 (2012)
53. Wisniewski, M.F., Kieszowski, P., Zagorski, B.M., Trick, W.E., Sommers, M., Weinstein, R.A.: Development of a Clinical Data Warehouse for Hospital Infection Control. *J. Am. Med. Inform. Assoc. JAMIA*. 10, 5, 454–462 (2003)
54. Zekri, M., Marsit, I., Adellatif, A.: A New Data Warehouse Approach Using Graph. *2011 IEEE 8th International Conference on e-Business Engineering (ICEBE)*. pp. 65–70. IEEE Computer Society (2011)

55. Zepeda, L., Ceceña, E., Quintero, R., Zatarain, R., Vega, L., Mora, Z., Clemente, G.G.: A MDA Tool for Data Warehouse. 2010 International Conference on Computational Science and Its Applications (ICCSA). pp. 261–265. (2010)