

Analyzing the Domain of Analytics Research

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Abstract: The field of analytics occupies a large spectrum of research and development across the disciplines of science and technology. The implications of the term ‘analytics’ and associated research are of great importance to both industry and academia. This term has a widespread usage in many contexts. Defining and elaborating analytics research more precisely is a step forward to accelerating/stimulating research in this area. In this article, we analyze and explore the domain of the definition of analytics research from the information systems viewpoint. This is achieved by investigating the literature on Information Systems in order to extract the actual usage of analytics in both academic and practice environments. We conclude that the scope of analytics embodies five components namely, Technology, Applications, Methods, Results, and descriptors. We offer some justifications to a claim that this definition has made business analytic research more focused and more productive.

Keywords: Analytics, Analytics Research

1. INTRODUCTION

Researchers have been interested in the area of analytics for many years and yet no definition of analytics research has been published. Just as Business Intelligence(BI) often aims to support better business decision-making, and thus a BI system can be called a Decision Support System (DSS), so too with analytics (Power 2007), vendors tend to use the term as it suits them. Kirk (2006) states that whatever the vendors mean by analytics, it is still unclear – “it is just fluff”. Also, diverse business examples describe analytics from information systems, marketing and finance perspectives (Punj and Stewart, 1983; Pfeffer 1996). Buchanan et al. (1996) have created their own definition for analytics: "Analytics leverage data in a particular functional process (or application) to enable context-specific insight that is actionable."

Common understanding of various boundary conditions and term usage are often prerequisites to substantial advances in the state of the art (Chasalow 2009). Our collective goal has been to determine if it was possible to objectively define "analytics research," and permit future scholars to concentrate less on the "problem definition problem" and if analytics research matured to encompass its own field of study.

The field of analytics appears to be of increasing important to both industry and academia. Quick industry statistics indicate that analytics has been a top five priority for IT leaderships, and more than at least \$14 billion is spent on this annually with an estimated annual grow of 10% annually (Chasalow 2009). More importantly three quarters of these projects are not considered fully successful (Howson 2008). Analytics is currently the beneficiary of a large portion of industry resources – some of it clearly ineffectively applied.

This clearly presents academics with a set of interesting opportunities to contribute to an evolving research program. We accumulated and analyzed more than 200 refereed journal articles that seem to us to be about "analytics research." Interest in the topic seems to be growing. Starting in 2010, a new journal called the "International Journal of Business Intelligence Research (IJBIR)" will be published. IJBIR is "dedicated to exchanging the latest academic research and practical findings on all aspects of managing business intelligence in

organizations. IJBIR serves to improve the role, scope, and impact of BI on decision making and to provide a mechanism for sharing research to a global audience" (IGI Global 2009).

Our objective was to determine whether "analytics research" should stand on its own as a research discipline. To accomplish this, we:

- Defined an analytics research framework as comprised of definitions, objectives, and specific criteria.
- Applied the framework to a sizeable sample of potential analytics research.
- Proposed a definition of analytics research.
- Concluded acknowledging the existence of a critical mass of academic research and implied commensurate support.

2. RESEARCH METHODOLOGY

We took the following approach:

2.1. Our first step was to identify and select a good representative sample of analytic research articles. In order to achieve this, we independently review the last ten years (1999-2009) of the following journals for articles related to analytics:

- a. Communications of the ACM
- b. Information Systems Research
- c. Management Science
- d. IEEE Software
- e. IEEE Spectrum

In addition to these journals we did a key word search with the word analytics in the ABI forms database. In our search we identify 232 articles to be included in this study. Currently we have evaluated 100 of the articles which are classified below.

2.2. Performed a preliminary synthesis of the subset of our articles (driven by citation number) and extracted preliminary framework components.

2.3. Assembled and then refined a framework capable of being used to define analytics research.

2.4. Evaluated our body of literature (our articles – generally considered to be "analytics research") in light of this framework.

2.5. Determined that analytics research could be defined.

2.6. Publish this definition in order to help position analytics research within the broader context of Information Systems research.

Our approach involved scanning literature to look for common themes to define each component of our analytics framework including non-technical and motivational components. For the purpose of validating our framework, we collected 216 articles/books to investigate the field. Some contributions took a practitioner focus while others focused primarily on algorithmic development, and still others on the "soft" aspects on analytics. The articles were first sorted and categorized individually and then a collective consensus determined how well the classification framework applied.

The common themes identified as a result of this process helped to synthesize the components into an integrated framework addressing the breadth of concepts embodied in analytics research literature. The sorting criterion identified the related analytics framework component.

3. ANALYSIS

Our approach enabled us to organize the literature being reviewed and identify common themes (see Figure 1). The analytics framework components include: Technology, Methods, Applications and Results. Two other components: Motivation and Non-Technical Issues were identified to be of interest to the field and these terms are all defined subsequently.

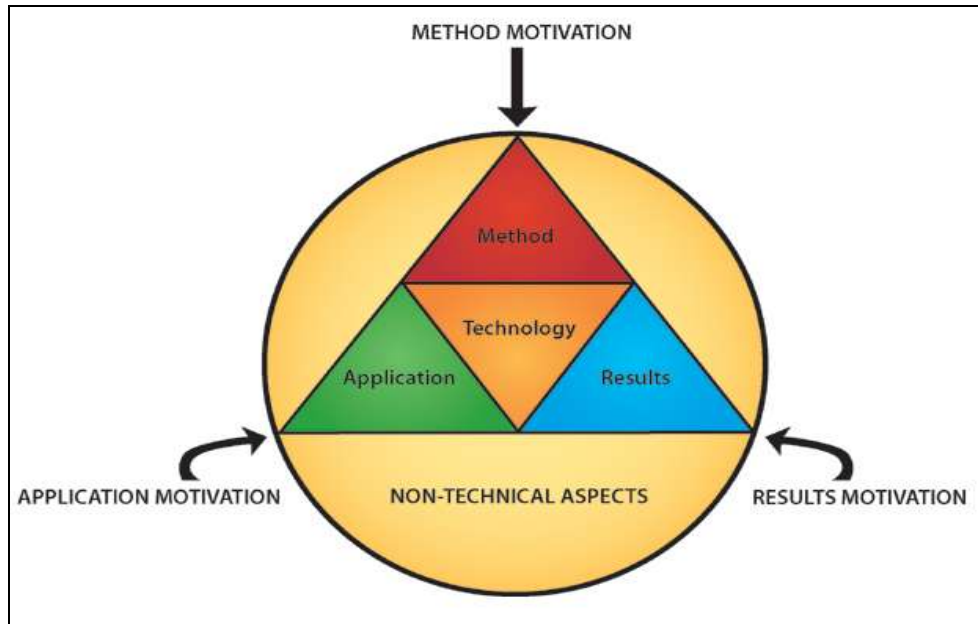


Figure 1: Analytics Research Framework

We also established a threshold rule that research will be considered analytics research if it includes the Component Technology and any 2 out of the remaining 3 components (Methods, Applications or Results). Definitions for the four primary framework components are as follow:

- 3.1. Technology (mandatory): The infrastructure that supports the use of applications and tools for applying and implementing organizational analysis.
- 3.2. Methods (must have 2 of 3): A manner of procedures (especially a regular and systematic way of accomplishing something) to design and develop problem-specific improvements.
- 3.3. Application (must have 2 of 3): The use of analysis tools and techniques (from potentially diverse disciplines) to improve organizational effectiveness, efficiencies and performance.
- 3.4. Results (must have 2 of 3): Measurable impacts of method or application (foreseen and unforeseen as well as technical and non-technical) on organizational performance.
- 3.5. Motivation: Motivation is a means to achieve outstanding results in the areas of productivity improvement, employee commitment, smoother running of business process and management development. Motivation means to reduce and manipulate this gap by inducing others in a specific way towards goals that conform to the corporate policy of the organization.
- 3.6. The motivation for analytics/business intelligence falls into two categories: maximizing profits and minimizing costs. A quick review of the literature shows the following motivation

Table 1: Applying our proposed rule of analytics research results

Reference	Tech	Method	App	Results	Analysis/Research
Bajwa, D. S., A. Rai, et al. (2004)	Y	Y	Y		Yes

Ahn, H. and K.-j. Kim (2008)	Y	Y	Y	Y	Yes
Alon, Y. H., A. Naveen, et al. (2005)	Y	Y	Y		Yes
Andriole, S. J. (2006)	Y	Y	Y	Y	Yes
Apte, C., L. Bing, et al. (2002)	Y	Y	Y		Yes
Armour, P. G. (2007)	Y	Y	Y	Y	Yes
Arnott, D. and G. Pervan (2005)	Y	Y	Y	Y	Yes
Arnott, D. and G. Pervan (2008)	Y	Y	Y	Y	Yes
Azvine, B., Z. Cui, et al. (2007)	Y		Y	Y	Yes
Azvine, B., Z. Cui, et al. (2005)	Y	Y	Y	Y	Yes
Bajwa, D. S., A. Rai, et al. (1998)	Y		Y	Y	Yes
Balaji Padmanabhan, et al. (2006)	Y		Y	Y	Yes
Ballou, D. P. and G. K. Tayi (1999)	Y	Y	Y	Y	Yes
Barki, H. and S. L. Huff (1985)	Y				No
Becarevic, D. and M. Roantree (2004)	Y	Y	Y		Yes
Ben-Zvi, T. (2007)	Y	Y	Y	Y	Yes
Bhatt, G. D. and J. Zaveri (2002)	Y		Y	Y	Yes
Bontempo, C. and G. Zagelow (1998)	Y		Y	Y	Yes
Burton-Jones, A. and P. N. Meso (2006)	Y	Y	Y		Yes
Busygin, S., O. Prokopyev, et al. (2008)	Y	Y	Y		Yes
Cao, L., Z. Chengqi, et al. (2006)	Y	Y	Y		Yes
Chen, L.-d., et al. (2000)	Y	Y		Y	Yes
Clemons, E. K. (1986)	Y	Y	Y		Yes
Cody, W. F., J. T. Kreulen, et al. (2002)	Y	Y	Y		Yes
Corbitt, T. (2003)	Y	Y	Y	Y	Yes
Craig W. Fisher, et al. (2003)			Y	Y	No
Davenport, T. and J. Linder (1994)		Y	Y		No
Davenport, T. H. and J. G. Harris (2006)		Y	Y		No
Davenport, T. H. and J. G. Harris (2007)	Y	Y		Y	Yes
Davenport, T. H., J. G. Harris, et al. (2001)	Y	Y	Y	Y	Yes
DeVoe, L. and K. Neal (2005)	Y	Y	Y		Yes
Foster, S., P. Hawking, et al. (2005)	Y		Y		No
Gilad, B. and T. Gilad (1985)	Y	Y	Y	Y	Yes
Gnatovich, R. (2007)	Y		Y	Y	Yes
Goldstein, H. (2006)		Y	Y		No
Goodhue, D., W. Lewis, et al. (2007)		Y			No
Green, A. (2006)	Y				No
Green, A. (2007)	Y	Y	Y		Yes

Halim Damerdj, P. W. G. (1998)	Y	Y			No
Hirji, K. K. (2001)	Y	Y			No
Holbrook, K. (2004)	Y	Y	Y	Y	Yes
Inna, K. and S. Simeon (2007)	Y	Y	Y	Y	Yes
Jaideep Srivastava, R. C. (2003)	Y	Y	Y		Yes
Jaime, G. (2007)	Y	Y	Y	Y	Yes
Jonathan Lee, P. B, et al. (2003)	Y	Y	Y	Y	Yes
Jukic, N. (2006)	Y	Y		Y	Yes
Kazi, A. Z. and A. S. Donovan (2005)	Y	Y	Y		Yes
Kiang, K. Y. T. a. M. Y. (1992)	Y	Y		Y	Yes
Kohavi, R., N. J. Rothleder, et al. (2002)	Y	Y	Y	Y	Yes
Kuruzovich, J., S. Viswanathan, et al. (2008)	Y		Y		No
Lei-da Chen, T. S., AND MARK N. FROLICK (2000)	Y	Y	Y	Y	Yes
McCarthy, J. (2000)	Y	Y	Y		Yes
Nissen, M. E. (2005)	Y	Y	Y	Y	Yes
O'Leary, D. E. (1998)	Y	Y			No
Parssian, A., S. Sarkar, et al. (2004)	Y	Y	Y		Yes
Rajesh, K. V. N. (2008)	Y	Y	Y	Y	Yes
Rakesh Agrawal, R. S ()	Y	Y			No
Redman, T. C. (1995)	Y		Y	Y	Yes
Robert J. Lempert, et al. (2006)	Y	Y	Y	Y	Yes
Ryu, K. S., J. S. Park, et al. (2006)	Y		Y	Y	Yes
Saar-Tsechansky, M. and F. Provost (2007)	Y	Y	Y		Yes
Schauer, J. (2004)	Y	Y	Y		Yes
Selby, R. W. (2009)	Y	Y	Y	Y	Yes
Sun, B. (2006)	Y	Y		Y	Yes
Synnott, W. R. (1987)	Y	Y	Y	Y	Yes
Thomas A. Horakh, et al. (2008)	Y	Y	Y	Y	Yes
Usama Fayyad, G. P.-S. P. S. (1996)	Y	Y	Y		Yes
Watson, H. J., B. H. Wixom, et al. (2006)	Y	Y	Y	Y	Yes
Wixom, B. H. and H. J. Watson (2001)	Y	Y	Y	Y	Yes
Zeid, A. (2006)	Y	Y	Y		Yes

3.7. For analytics: Improving risk grouping rules (health care), market analysis, support corporate strategy, customize products, targeted marketing, improve customer support, competitor analysis, gain or maintain competitive advantage, supply chain optimization, etc. Motivations can be categorized into three categories according to its relationship to analytics while being viewed from an intrinsic and extrinsic view point:

- a. Results motivation for analytic research can be viewed as the intrinsic motivation of academic researchers trying to establish a theoretical model to improve the analysis process. In addition, the extrinsic motivation, such as endowments from practitioners looking for new ways to improve their organization’s performance abilities.
- b. Methods motivation for analytic research can be viewed as the intrinsic motivation of academic researchers trying to establish new or improved analytical tools such as algorithms or mathematical models to improve the analysis process. In addition, the extrinsic motivation, such as consulting projects from practitioners looking for new tools or software programs to improve their organization’s analytical process.
- c. Applications motivation for analytic research can be viewed as the intrinsic motivation of academic researchers trying to understand the new and improved ways of implementing analytical tools and methods to improve the success rate of analytical projects. In addition, the extrinsic motivation, such availability of access from practitioners looking for new ways to improve their organization’s project management success.
- d. Non-Technical Aspects: the work processes and work patterns which do not include technology in order to complete the given task. Nontechnical issues include whether systems are compatible with users' needs and desires, and the way users understand and evaluate a system; the way the system fits into users’ normal work patterns and processes, as well as into the organizational structure; and the way changes caused by the system are viewed by users, designers, and managers (Howson 2008).

4. RESULTS

Applying our rule of analytics research to our framework diagram, to date we have validated 70 out of the 216 articles in our collection as shown in Table 1. The result of the various categories is presented in Table 2. These results refer to columns of Table 1. For example, Column 2 of Table 2 refers to the entries in Column 2 of table 1.

Table 2: Applying our proposed rule of analytics research results

Total number of investigated papers	7 0
No of paper that is related to Technology	6 5
No of paper that has provided a manner of procedures (Methodology)	5 7
No of paper that has use of analysis tools and techniques (Application)	5 8
No of paper that has provided Measurable impacts of method or application (Results)	3 9
No of paper analytics research according to the proposed rules	5 7

5. CONCLUSION AND RREMARKS

Our framework appears useful – helping to determine whether an article is "analytics research." This baseline can be used as a foundation and lead to more precisely defined analytics research contributions.

Applying our rule of analytics research to our framework diagram, to date we have validated 70 out of the 216 articles in our collection (Table 1). The results of our analysis indicated that our team was able to definitively apply the framework in all cases – we believe the framework can be used to classify any article as "analytics" or not.

Further, using the framework 80% met the framework's criteria for "analytics research." We believe we have some ideas that can help others to better understand and classify research in the field of analytics. For future research, more articles may be validated using the proposed framework, and more criteria may be investigated.

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