



New Media, Information Technology and Indiana: A Retrospective on the 2000 Battelle Study

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Introduction

In December 2000, Battelle Memorial Institute published a report entitled *Nurturing Central Indiana's Pillar Industries for 21st Century Midwestern Pre-eminence*. The study was prepared for the Central Indiana Corporate Partnership, and has been very influential in focusing both private and public resources towards economic development. The Battelle Study identified advanced manufacturing, life sciences and information technology as pillars of Central Indiana's economy.

Since the publication of the Battelle Study significant change has occurred in the States' economy. The most profound effect involves structural change in the information technology sector, and thus its potential choice as a pillar of Central Indiana's economy. This research note is designed to address this issue. We proceed by discussing structural change in information technology, followed by an identification of emergent industry structure, and the role a changed industry and technology plays in the regions economy. This is followed by a specific analysis of the role emerging media will play in the firm profitability and in regional economic performance. We conclude with policy recommendations.

The Battelle Study and Information Technology

The original Battelle Study was remarkably prescient in identifying information technology as a pillar of Central Indiana's economy that would "affect all industries and all jobs." Unfortunately the study was published almost coincident with the dot.com bust of spring 2001; and as a result attention to this critical sector has been less apparent across the nation and within Central Indiana.

In the recent years leading up to the publication of the Battelle Study, information technology in all its types was leading a rapid creation of wealth. This was caused not only by the newness of the Internet, but also by a compression of the information technology investment cycle in advancement of the feared collapse of systems due to the Y2K bug. ²

The result was a stock bubble, accompanied by enormous employment growth in computer software engineering and associated occupations that were deployed in the advance of Y2K. Subsequent to Y2K, investment in new information technology (IT), both hardware and software slowed dramatically. This slowdown also led to a near collapse of commercial deployment of fiber optic networks that had been built in concert with the rapid growth in the IT sector.³ Throughout much of the country including Indiana, employment in the IT sectors shrank for several years afterwards. However most of the pain was felt in the regions with software production related to the Y2K investment cycle.

Within the telecommunications component of the broader IT sector, the change has also been dramatic. In 2000, real concern over the deployment of broadband

¹ Executive Summary, page 1.

² The Y2K Bug is the colloquial name for a deficiency inherent in existing software that would potentially make it incompatible with dates after December 31, 1999. This deficiency motivated both software and hardware purchases.

³ The rapid deployment of fibre optics may have also led to an excess supply of transmission capacity, which further stymied later investment.

technology to rural areas was a driving force behind considerable public policy and research. By 2003, broadband penetration in even the most rural places in America made access to advanced telecommunications available to a higher proportion of the population than enjoyed basic literacy skills.⁴ The subsidized deployment of lit fiber cable became yesteryears policy concern, to be replaced by worry over access to very high bandwidth options, and the growing need for WIMAX and other mobility options.

Over the same period wireless telephony for the first time exceeded wire line access in some urban areas, and in many smaller locations (such as universities) virtually replaced traditional phone service.

Service consolidation has also occurred, with broadband availability through wireless telephony, satellite, some electrical distribution networks, and through traditional telecommunications providers. More recently through mandated video franchising of DSL through traditional cable access TV providers and the use of existing white space (unused frequencies) are emergent options.

The distribution networks of the Internet morphed from separate network centric, heavily regulated industries into a multi-network distribution of the Internet with at least three different regulatory approaches that span both state and federal policy.

From December 2000 when the Battelle Study was published to the most recent data in December 2006 broadband Internet connections grew from 6.7 million to more than 82.7 million or more than 1,200%. Nationally, access to broadband telecommunications, defined as greater than 200 kilobytes per second (KBPS) asymmetric transfer of data has been the single most rapid adoption of technology reported, outstripping even the fastest adoption of home televisions, TV remote controls and videocassette recorders.⁵

The growth and now ubiquity of the broadband has meant that media content delivery changed profoundly over the same period. Traditional newspapers, radio and television have been universally supplanted, and in many cases replaced by Internet postings. Internet access by businesses is effectively universal, and markets for both intermediate and primary goods, as well as social networking, and other information dissemination applications have grown at rates to justify the most extreme hype. In 2000 when the Battelle study was published there were 7 million unique Internet websites (itself a 50% increase form the previous year). By 2007 that estimate had risen to almost

⁴ See Burton, M. and M. Hicks "The Residential and Commercial Benefits of Rural Broadband: Evidence from Central Appalachia" *Center for Business and Economic Research, Marshall University and* "Wire-Based Competition Benefited Consumers in Selected Markets," United States General Accounting Office, Report to the Subcommittee on Antitrust Competition Policy and Consumer Rights, Committee on the Judiciary, U.S. Senate, February 2, 2004, GAO-04-241.

⁵ See data from Lilien, Gary and Arvind Rangaswamy, and Christophe Van den Bulte (1999) "Diffusion Models: Managerial Applications and Software" ISBM Report 7-1999. as reported in Burton and Hicks, 2005.

30 Billion, or a more than 4000 fold increase.⁶ Traditional inter-firm IT services have also migrated to the Internet, making use of emerging media applications for many traditional business services.

Over the same time period, online retail sales grew five fold to over \$130 billion annually (excluding medical care, automobiles and travel). Other commerce over the Internet has also grown. Estimates of total Internet e-commerce (e.g. traditional brick and mortar lost sales) are as high as \$775 billion annually, with sales taxes values uncollected by states of perhaps \$54 billion. This value does not count services such as travel arrangements, financial and business services and the development of information transferring media or emerging media to deliver the messages of commercial opportunity.

In early 2009, digital communications will become the national standard for television, and telecommunication nodes will experience a transformation into Internet Protocol (IP) based addressing. Among the many potential results of these standard changes is the availability of user interfaced televisions. As a result, interactive television communication is imminent. The television as home computer interface, connecting to content and other users will become common by the end of the decade.

These national trends are also apparent in Indiana. This transformation in the way people and business communicate has altered the information technology sector in a way that strengthens it as what the Battelle Study so prophetically termed a "pillar of our economy." It is to that issue we now turn our attention. To do so we must understand how the Emerging Media value chain represents a significant departure from the traditional description of the information technology industry in the Battelle Study.

The Role of Emerging Media in Commerce

Any definition of emerging media is difficult. The rapidly changing nature of emerging media brings to mind Justice Potter Stewart's tautological brilliance.

⁶ For reference to separate estimates see Batelle.com and Internetworldstates.com

⁷ Market Forecast Report," Jupiter Media Matrix, January 2002, p. 6.

⁸ See a series of studies: Donald Bruce and William F. Fox "E-Commerce in the Context of Declining State Sales Tax Bases," *National Tax Journal* 53(4), Part 3, 2000, pp. 1373-1388.; Donald Bruce and William F. Fox "E-Commerce and Local Finance: Estimates of Direct and Indirect Sales Tax Losses,", *Municipal Finance Journal*, 22(3): 24-47, 2001. Donald Bruce, John Deskins and William F. Fox "Has Internet Access Taxation Affected Internet Use? A Panel Data Analysis," *Public Finance Review*, 32(2):131-147, 2004. William F. Fox and Matthew N. Murray "The Sales Tax and Electronic Commerce: So What's New?", *National Tax Journal* 50(3), 1997, pp. 573-592.. William F. Fox and LeAnn Luna "Taxing E-Commerce: Neutral Taxation is Best for Industry and the Economy," by, *Quarterly Journal of Electronic Commerce* 1(2), 2000, pp. 139-150. Donald Bruce, William F. Fox and Matthew N. Murray "To Tax or Not To Tax? The Case of Electronic Commerce," *Contemporary Economic Policy*, (21)1, 2003,

"I shall not today attempt further to define the kinds of material I understand to be embraced within that shorthand description; and perhaps I could never succeed in intelligibly doing so. *But I know it when I see it . . .*" 9

However, the most commonly applied 'shorthand description' of emerging media is that it is communications – of all types – based on digital technologies, and increasingly with interactive components. Among definitions designed to transcend user jargon, is that offered by Neuman over a decade ago. He argued that what we define as emerging media will a) alter the influence of distance, b) increase the volume and speed of communications, c) enable interactive communications and d) permit the merging of media forms. ¹⁰

Examples of emerging media are easy to find. They come built-in to most cell phones, are part of daily Internet news communciations, and include video games, marketing packages, electronic kiosks, graphical user interfaces (web based), training packages in schools, and multimedia CD-ROMs. They are increasingly in more specialized business applications.

Commercial reliance on emerging media includes not merely in production for media related activities, but as a venue for the sale and distribution of other goods and services. Digital connection to goods and services has created behemoth corporations (Google, Ebay, DoubleClick) in under a decade. It has also altered existing industries, notably print, radio and television media.

From an economic development perspective, emerging media is important not only for its end content, but also for the extensive value chain created by its adoption. A 'value chain' is a commercial business term that describes the combination of inputs from commodity through finished product. The emerging media value chain encompasses both the new uses for digital media and the replacement of existing information media tools throughout the economy. A more detailed explanation of the emerging media value chain will be contained in later publications. However, for the purposes of evaluating the usefulness of emerging media as an economic development focus area, it is important to understand the emerging media value chains. They include extensive content development (research and development), physical production (technology, multimedia skills, software and maintenance), transmission and distribution hardware and software (the Internet, local area network (LAN) equipment, networking equipment for wireless and wireline technology, computer human interface) and maintenance of the network (both physical and through informational linkages). A graphical depiction of this value chain is provided below:

¹⁰ W. Russell Neuman, The Future of the Mass Audience. Cambridge University Press, 1991.

⁹This is his 1964 definition of pornography in *Jacobellis v. Ohio*, 378 U.S. 184.

Value Firms with low Intensity Firms with Intensive Core Media Production Chain Media/IT Usage Media/IT Usage and IT Firms Emerging Media Firms (production and content) **Emerging Media** Occupations Programming, operating and network Firms without Management firms internal Programming, etc (primarily IT) in non-Media/IT Emerging Media or IT Installation, maintenance and service of networks Installation services in and equipment firms non-Media/IT firms (primarily IT) Purchase of Emerging Media & IT Services Intensity of Media

Figure 1, The Emerging Media Value Chain

In this figure, the value chain is depicted on the vertical axis, with media and IT intensity on the horizontal axis. We categorize firms by three typologies here. Firms entirely reliant on outside purchase of emerging media and IT services are depicted on the left. Firms that provide core emerging media and IT services depicted on the right. Firms that have absorbed some emerging media and IT services fall in between the two extremes.

This understanding of emerging media's growing ubiquity is supported by other analysts. In a January 2008 release study, Gartner Research estimates that by 2012, over 70 percent of organizations (both private and public) will employ emerging media technologies to support internal operations and customer service. The types of emerging media they anticipate firms using include virtual worlds and social networks to promote employee interaction. A subsequent report introduced the notion of a 'hyperconnected enterprise' in which intense information sharing between and within firms will rely on ever more evolved emerging media applications. ¹¹

11 Fenn, Jackie, Tywon W. Harmon, Stephen Prentice, Mark Raskino and David W. Cearly (2008) Predicts 2008: Emerging Trends Expand Collaboration and Human Performance, Gartner Research, 8 January,

^{2008:} Emerging Trends Expand Collaboration and Human Performance, Gartner Research, 8 January, 2008. and Morelio, Diane (2008) "Findings from Symposium emerging Trends: The Hyperconnected Eneterprise Looms Large, According to Symposium Voters" Garnter Research, Aupril 28, 2008.

Empirics also provide strong support for this interpretation of growing ubiquity of emerging media applications in business. In a forthcoming study, Ball State University professors Jennifer Bott and Ray Montagno surveyed firms nationwide regarding usage of emerging media. Within the surveyed population, over a quarter of all firms offered in excess of ten hours of emerging media training to new employees, with roughly the same proportion reporting that they offer continuing employees equal levels of training. More than a third of the respondents indicated they would offer a wage premium in excess of 5 percent annually for workers with emerging media skills. Over half said that competition for workers with emerging media skills was somewhat or very competitive and over half of firms report emerging media skills as key determinants of positions within the company. Importantly, the majority of firms reported using both in-house and outsourced emerging media workers, with demand for each growing by 50 percent over the coming three years. ¹²

The elements of the emerging media value chain exist today in both the public and private sector. They are pervasive across industries. Rather than simply an occupation designation or firm type, emerging media is increasingly a skill needed by all knowledge and most production workers. They exist in traditional settings, such as in telecommunications companies, old media print and television and entertainment. Increasingly, all firms rely on emerging media, for sales and supply management, human resource management, advertising and delivery and analysis of data for analytical purposes. They exist in the public sector, in education settings, the Internet, and increasingly in the delivery of government services.

The rapid adoption and use of emerging media has a robust economic basis. In an important recent study published by the Federal Reserve Bank of San Francisco, estimates of the contribution of IT components to specific industries were estimated. This study focused on the role IT plays as a general purpose technology – a technology employed by virtually all sectors. They decomposed specific industry investments in computers, software and communications. From this they calculated the value added share of total industry revenue from each of these types of investments. They found that in 2004, roughly 5.55 percent of firm revenues economy wide could be attributable to these activities. This represented a 13 percent increase from 1990, a sizable shift in he production technology of the economy as a whole. The authors also found that within information and communications sectors (which includes emerging media) the communication components represented 73.4 and 63.4 percent of value added respectively. In communications 28 percent of revenue was directly attributable to overall IT investment, while in information one in five dollars of total revenue was attributable to IT investment. Because of industry aggregation it is difficult to determine

¹² Bott, Jennifer and Ray Montagno (2008) "Emerging Media in the Workplace,: Levels of Use and Implications" working paper.

¹³ Basu, Susanto and John G. Fernald (2008) "Information and Communications Technology as a General Purpose Technology: Evidence from U.S. Industry Data." Economic Review 2008, Federal Reserve Bank of San Francisco.

how much of this is emerging media content. However, all of it is part of the emerging media value chain.

The magnitude of this value chain is clear. But its continued growth and where it is located within industries is of central importance to any discussion on economic development

Emerging Media Value Change and Job Accounting

The Information Technology sector actually shrank following the publication of the Battelle study. Especially hard hit were the sub-sectors of Internet based applications such as Internet Service Providers (ISP's) video productions and other core producers of content and Internet websites. See Figure 2.

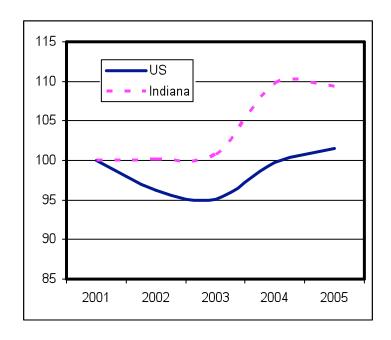


Figure 2, Information Technology Employment Index

However, these raw data mask an important phenomenon which occurred during the same time period. Simply, firms outside the traditional information technology industry were absorbing production of emerging media content and delivery systems. At the same time, more specialized firms were born, creating a niche set of products and services focused on delivering content across the Internet. Understanding the growth of

Emerging Media's role in the U.S. economy involves accounting for these occupational shifts both within and between firms.

The choice to absorb workers with skills within the emerging media value chain is based on a straightforward effort by firms to maximize profits under differing demand and cost conditions within the markets for emerging media products and services. The vertical integration decision by firms involves absorbing workers or firms with the necessary skills either backward or forward in the supply chain. Backward integration involves the acquisition workers who can provide either new skills or those previously outsourced by the firm. In emerging media, this could mean hiring web developers, specialized software designers or acquisition of infrastructure to support emerging media distribution systems. Forward integration involves acquisition of firms or individuals providing key goods or services closer to the consumer. These include many of the same skills and hardware as backward integration. What differentiates the two in the emerging media content is the use of the technology within the firms' supply chain.

Referring back to Figure 1, we could also describe the vertical integration as the growth of the share of firms with intensive media/IT usage, who are absorbing a portion of the occupations previously provided by core media production and IT firms.

Firms undertake vertical integration to reduce transactions cost for the goods or services. Obviously as demand for the service rises, costs for transactions will rise, and so we observe significant vertical integration of emerging media activities in some types of routine or high demand services. Firms will also vertically integrate to synchronize production. Thus, the use of common information technology permits such activities as vendor managed inventory. This occurs both in the direct production and sale of emerging media (such as books on demand) but also interactive web based purchasing.

Firms also vertically integrate to reduce uncertainty about market availability, and secure price and quality over the long term. ¹⁴ Figure 3 provides a graphic treatment of the integration puzzle faced by firms. In this graphic, the degree of vertical integration and technological integration (specialization of product technology) interact to place activities into different locations based on the growth in activities.

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¹⁴ Firms also engage in vertical integration to secure market power, but given the disaggregate, low entry costs of emerging media, this is a low probability explanation for vertical integration by non emerging media firms.

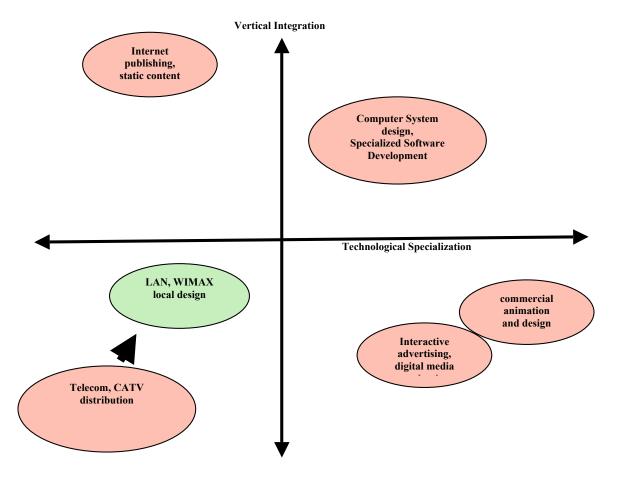


Figure 3, Vertical Integration of Emerging Media Services

Extending these considerations to the dynamics of markets enables us to appreciate the growth within emerging media since the publication of the Battelle study. We will rely upon Figure 4 for an example. Aggregate data on telecommunications workers within the industry show a marked drop nationwide since the dot.com bust. However, occupations involved in the installation of networks, shows rapid growth. Further, this rapid growth is happening almost wholly within firms that *are not telecommunications providers*. So, we see the movement of a highly vertically disintegrated activity (the installation of local computer networks), which is also relatively unspecialized in its technology becoming more vertically integrated. Simply, non-IT firms are absorbing more workers to accomplish these tasks, which were in the past performed under contract to a specialized telecommunications provider. This is classic vertical integration.

The result on the data is simple. If firms choose to vertically integrate (or insource) emerging media activities, then there will be occupational growth in new media related occupations, but the number of new media specific firms, and the size of the industry may well shrink. Conversely, if firms choose to out-source new media activities, then the size or number of specifically new media firms and the size of the new media industry will grow. Remember however, that it is the value added by new media activities that matter in terms of regional growth and employment – not whether or not these activities are performed within or between firms.

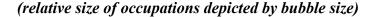
In order to capture this dynamic we examined data from 2003 to 2006 on the size of selected emerging media occupations within the value chain (from production through technical support for computer networks). What we find is that between 2003 and 2006 prime emerging media occupations (Bubble A) have seen employment growth, and become more concentrated within industries. This is a sign that these activities are being outsourced to firms that specialize in emerging media applications (though they may not yet be labeled emerging media firms). ¹⁶

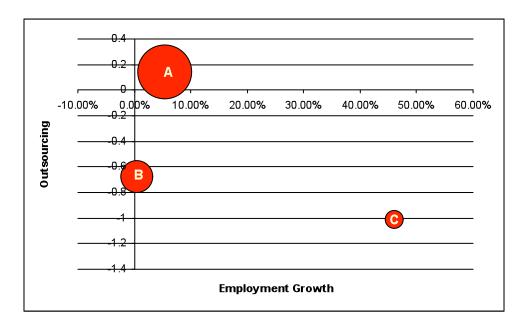
We see the two important value chains for new media both growing since 2003, and also significant in-sourcing by firms. This suggests that the specific activities that occur within firms that support their use of emerging media are becoming an integral part of their firms' activities (see Bubble B & C). Thus, it is the content and special applications which are seeing both employment growth and heightened firm specificity. The supporting roles of computer operators, programmers, network administrators and telecommunications equipment installation and servicing tare growing primarily within firm (in-sourced rather than out-sourced).

¹⁵ Data are from the Occupation and Employment Statistics, United States Bureau of Labor Statistics, various years.

¹⁶ An example of a new media firm is the *New York Times*, whose revenues are primarily due to emerging media publishing, but retains the old media industrial classification.

Figure 4, Emerging Media Value Chain Growth and Absorption





Understanding this dynamic in Indiana, especially in the context of the economics of agglomeration is also critical. What this process means is simply that there is growth in the emerging media value chain, but it is not happening exclusively within the IT sector. While demand for the more specialized emerging media occupations are occurring in specialty firms within the IT sector, the supporting occupations of computer engineering, software development and network installation and administration are occurring primarily outside the IT sector.

Focusing solely on the growth of the IT sector entirely misses the point. Demand for these services is growing, but firms increasingly absorb these tasks themselves by hiring emerging media workers. Further, this analysis leaves unmeasured changes within occupations themselves. We have focused on traditional occupational descriptions, but we know through very strong anecdotal evidence that many traditional occupations now require emerging media skills. For example, in a preliminary survey of help wanted adds, we find that more than 40 percent of new job postings in Indianapolis require new media skills (production and content delivery, not merely access). ¹⁷

A recent research study on IT usage and emerging media by Gartner Research echoed our preliminary findings. This study categorized firms by technology usage

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¹⁷ These survey results are part of The Economic Geography of New Media, forthcoming from Ball State University.

intensity rather than industry. They then queried firms regarding specific uses of technology. Their report, which was released in March, 2006 reported use of some emerging media applications (such as advanced 3-D visualization) as high as 50 percent in their most media intensive third of firms. In the least media intensive third, over 10 percent of firms had adopted this technology. Given the technology adoption curves we have observed in other recent media applications and the more than two year lag since the publication of this study, it is likely that the bulk of technology intensive firms are using emerging media applications. ¹⁸

In short, the demand for information technology services is growing, even as the traditional sector itself has suffered significant job losses. The reason for this is that non IT firms, for a variety of reasons, are absorbing IT workers in what we describe as the emerging media value chain. The remaining IT workers are more heavily dominated by specialized emerging media firms. Also, traditional occupations increasingly demand emerging media skills. We are confident from these data that information technology broadly, and emerging media specifically are a rapidly growing segment of our economy nationwide. One question that remains is how it is affecting Indiana.

Emerging Media Value Chain in Indiana

The changes to the information technology sector described above have resulted in an enormous shift in the role of information technology occupations. But beyond the employment accounting issues, overall IT productivity growth has continued to affect Indiana.

In a series of studies on IT and productivity, Harvard economist Dale Jorgensen and his New York Federal reserve colleagues Kevin Stiroh and Man Ho attributed more than a third of all U.S. productivity growth in the 1990's to advances in information technology. In industries as diverse as manufacturing and retail, significant advances in overall productivity growth have come at the hands of IT investment. Indeed, a 2002 report by McKinsey attributed IT advances (including Vendor Managed Inventory) in retail alone for a quarter of U.S. productivity growth.

¹⁹ Jorgensen, Dale W., Man S. Ho, and Kevin J. Stiroh. 2004. "Growth of U.S. Industries and Investments in Information Technology and Higher Education." In Measuring Capital in a New Economy, eds. C. Corrado, C. Hulten, and D. Sichel. Chicago: University of Chicago Press.

¹⁸ Gartner Research (2006) Survey Shows Adoption and Value of Emerging Technologies, Jackie Fenn, March 23, 2006.

²⁰ See Mckinsey, 2002 and Foster, Lucia, John Haltiwanger, and C.J. Krizan. 2002. "The Link between Aggregate and Micro Productivity Growth: Evidence from Retail Trade." NBER Working Paper

In Indiana, productivity growth in transportation and logistics, advanced manufacturing, biosciences as well as wholesale and retail trade, health care services, and other sectors are heavily influenced by information technology.²¹

Emerging media has become the interaction tool for traditional information technology. Emerging media is the enabler of human interfaced use of other IT services, and growth in emerging media occupations and skills reflects this reality. Further use of emerging media is effectively supplanting much of the traditional communication and interaction mechanisms. Emerging media has become a staple of communications in Indiana. The most frequently and widely read business applications are conducted through emerging media (Inside Indiana Business) as a hybrid with old media. The national survey of emerging media usage finds that Indiana's firms are using these services in patterns that mirror the national trends.²²

Emerging media occupations are growing in both number and importance to businesses. As Figure 4 so clearly depicts, growth in emerging media specific occupations is an important source of employment nationwide. As Figure 2 depicts, this growth in Indiana is outstripping that of the nation as a whole. There is more evidence that Indiana is becoming a source of information related employment growth. As part of the study of economic geography of emerging media we ranked Metropolitan Statistical Areas by their growth in information services earnings (the broadest measure of emerging media related businesses). Among the top 100 metropolitan areas, ranked by growth central and east central Indiana enjoy five metropolitan areas Anderson (17th), Muncie (61st), Kokomo (62nd), Bloomington (85th) and Indianapolis (86th).²³

Information related employment in Indiana has enjoyed particularly robust growth following the 2001 recession. As an illustration of the importance of these jobs in Indiana, we report average annual earnings for Information workers from 2004 through 2007.²⁴ This series shows a remarkable wage growth for both new and total workers in this industry. The growth in these wages is exceeded in Indiana only by workers in professional, scientific and technical services. See Figure 5.

²³ These data are available from the Bureau of Economic Analysis, Regional Economic Information System database. Calculations are by authors.

²¹ See Burton and Hicks Supra 2. for a detailed estimates of services and financial sector productivity growth in regions caused by broadband access.

²² See Bott and Montagno, Supra note 12.

²⁴ These data are drawn from the national Labor Market Information series and are 2004-20007 annualized 1st Quarter earnings for new hires and total employees in the Information sector.

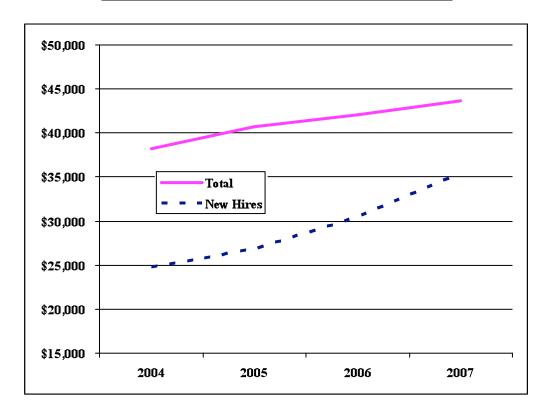


Figure 5, Annual Salaries for Information Workers

Emerging media also plays a significant role in existing industry structure in Indiana. In our analysis of the extent of the emerging media value chain, we find that, across the spectrum of measures, emerging media is becoming a significant component of the states' economy. This is true in Indiana as it is nationwide.

We have already detailed occupational relationships with emerging media, we find that in our university towns, emerging media firms have among the highest employment and value added multipliers in the commercial sector. In Delaware County, home of Ball State's emerging media education, research and outreach efforts, the single largest multiplier belongs to pure emerging media firms.

In our forthcoming study on the economic geography of emerging media, we assess the role regional influences, including demographics and existing industries play on emerging media. We find that the presence of a university with emerging media research and educational services plays the strongest role in determining location quotient

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²⁵ See Hicks, Michael and Nalitra Thaiprasert (2008) "The Economic Geography of Emerging Media" Working Paper, Department of Economics, Ball State University.

among the industry.²⁶ Universities and access to new media education matter to the location decision of emerging media firms. This empirical finding echoes strongly the results of the survey of emerging media usage conducted by Professors Bott and Montagno at Ball State University. These authors report roughly half of all firms surveyed consider availability of emerging media workers in their location decisions.

In the forthcoming study on the economic geography of emerging media, we also report significant growth in the local use of intermediate inputs by emerging media firms. This strongly implies a value chain increase in emerging media inputs and outputs in Indiana. In the narrow focus on 13 emerging media intensive industries we found all but three increased their local share of inputs to production from 2001 through 2006. For example, the Information Services sector increased its share of Indiana sourced inputs from 16.8 percent to 34.6 percent from 2001 to 2006, and almost \$60 million increase. This trend was repeated across more than two thirds of the emerging media sectors, and included large increases in local input use in industries ranging from management and professional and scientific services, to finance and insurance, machinery manufacturing, plastics, chemicals and papers.

Our study of emerging media's economic geography also points to some consolidation in emerging media firms in more traditional settings. The sound recording industry used less local inputs, and cable networks used fewer inputs overall. Across the state, from 2001 to 2006, radio and television broadcasting, cable networks and custom computer programming services saw revenue declines. Some of this is due to a more competitive environment for cable TV providers. The remainder is due to consolidation of TV broadcasting nationally, and vertical integration of specialized computer programming services. It is remarkable that within the broad information sector, these consolidations and technological change have not caused an aggregate decline in earnings and employment. The growth is concentrated in more specialized emerging media occupations. In the end, the health and vibrancy of emerging media in Indiana is a clear conclusion of our analysis.

Anecdotally, we observe firms adding emerging media positions at the vice-presidential level, we see political campaigns fully absorbing emerging media, and such non-IT firms as *Dippin' Dots* winning awards for the use and implementation of emerging media.²⁷ Data and analysis on emerging media is nascent. However, is seems clear today, that the Battelle Study's understanding of how this type of technology would become a cornerstone of Indiana's economy represented considerable foresight.

²⁶ Our model includes all counties in the surrounding states (Illinois, Michigan, Ohio and Kentucky) in a limited dependent variable of location quotient.

²⁷ They won the 2007 Innovator Award for Emerging Media.

Policy Recommendations

The Battelle Study outlined recommendations for long-term success. We build upon these recommendations here:

- ✓ Engage universities in partnerships focusing on research, development and human capital creation within emerging media. Promote emerging media and other supply chain activities as key contributors to the states' economy.
- ✓ Focus intermediary organizations on emerging media and IT as key facilitators of networking and collaboration between universities, business, government and the not for profit sectors.
- ✓ Extend financing efforts already focused on other pillar industries towards emerging media firms.
- ✓ Reinforce the success of R&D efforts among the states' universities, through R&D support for schools already showing success in emerging media.
- ✓ Identify key public sector supports for emerging media, to include extension of R&D tax credits to design focused research, continued improvements in the Internet and wireless regulatory environment.
- ✓ Support key human capital development efforts that feed a skilled and ready labor force with emerging media skills.
- ✓ Identify and promote the role of emerging media in sectors in which Indiana's relative strength is already apparent (life sciences, advanced manufacturing and logistics).

In summary, IT remains a pillar of growth in Indiana as it was correctly identified in the 2000 Battelle study. However, the focus of IT growth has changed. Growth in IT related firms within the IT sector is heavily oriented towards more specialized firms. Emerging media content is perhaps the most dynamic set of firms within the broader IT sector. Demand for workers with IT skills has exploded within firms outside the IT sector. These workers engage both in traditional IT related occupations, and work in other occupations, where IT skills – most especially emerging media skills – are increasingly a requirement of any job. The future for these sectors is bright in Indiana, and should be nurtured by both private and public efforts.