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Transforming Marketing Education of the Future: The Role of Intelligent Agent Technologies (IATs) in Enhancing Student Learning

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Abstract - This conceptual paper introduces IATs and discusses how such intelligent and interactive applications can translate into better education environment for marketing curriculum, particularly marketing research. We present a conceptual model based on extant literature. We present some initial test of our conceptual model of IAT usage in marketing education in a marketing research class.

Keywords - Artificial Intelligence, Experiential Learning, Intelligent Agent Technologies, Interactive Environment, Marketing Research Education

Value to Marketing Educators - With ever-increasing global competition and the information explosion due to the advent of the Internet, curriculum requires adaptive teaching environments that artificially simulate real world of expanded information, and high level of interactivity to facilitate student learning. Our paper is the first to explore how IATs can be useful in marketing education. We present a conceptual model of IAT usage, which will help guide marketing educators on how to apply them in their curriculum.

Introduction

Over the last decade, the field of marketing education has adopted new technological advancements, and innovations. These advancements continue to create opportunities for establishing competitive advantage for marketing students. With the expansion of knowledge-based economy and popularity of Internet, we are now exposed to a storehouse of information, knowledge, and learning that is transforming the way the classes are taught. Specifically, in a dynamic, real-time environment, learning and acting faster than others has been acknowledged as a major source of a sustainable, competitive advantage (Mintzberg, 1987). In wake of information explosion, dynamic nature of information generation and dissemination, increased interactivity, and availability of information from various sources both the quality and quantity of information are increasing, and, marketing students face a new reality of information rich, fast-paced learning and decision-making environment. Similarly, marketing educators are now facing the serious challenges and growing opportunity of what to teach, and how to deliver deep knowledge through interactive and experiential learning (Vroom, 2007)?

Deep Learning is defined as "Learning that promotes the development of conditionalized knowledge and meta cognition through communities of inquiry." (Weigel, 2002). One way to deliver deep and experiential learning is by artificially simulating real world environment to the students and facilitate student learning. While there are some innovative tools (e.g. CapSim, Harvard Simulations, Marketplace) available to marketing educators to simulate real world experience in classroom/ lab setting, they are typically inefficient as they are limited only to the extent their knowledge bases and rule-sets are programmed. Moreover, these expert systems require frequent update, and may become irrelevant with changing business environments. Thus, important learning components such as individual experimentation, real time information search and dissemination, scenario analysis, incorporation of novel situations, and customization, personalization, and individual learning, are often overlooked while using these tools. IATs are defined as software, or computer systems, that can sense, act autonomously, and negotiate or collaborate with humans or other agents, in the complex tasks of information search, acquisition, retrieval and analysis, in dynamic environments to realize a set of goals or tasks (Maes, 1994; Wooldridge, 2002). IATs are autonomous, have the ability to collate required knowledge from massive databases, and are flexible and easily customizable. Therefore, IATs have the potential to make considerable advances in a wide range of areas, including discovery technology; pattern recognition, predictive modeling, and real time decision making that can help both marketing students and marketing educators.

In this paper, we introduce Intelligent Agent Technology (IAT) to the marketing education literature, and conceptually present how it can be useful in providing marketing education and learning. Drawing upon the extant literature, we develop a framework for IAT applications and adoption to support marketing education and discuss how it will be advantageous to enhance experiential learning in the classroom. In particular, we address three main research questions: (1) What are IATs, and what are the recent developments in the field? (2) What opportunities and challenges are associated with their adoption for marketing education? And (3) which of their marketing applications may enhance students' learning experience in a marketing curriculum?

Given their search and interaction capabilities, autonomous nature and adaptability, IATs can play a significant role in enhancing experiential learning for most marketing curriculum. In this paper, we mainly focus on its ability to make an impact on Marketing Research curriculum as compared to most major marketing courses, marketing research curriculum involves extensive data analysis, and requires students to search and analyze secondary information from various sources. Students reflect upon the marketing issues under discussion, and conceptualize past experience to facilitate in classroom tasks. This process of educational process is known as experiential learning (Wood and Suter, 2004: 137). Therefore, the context of marketing research is an appropriate teaching topic to consider while presenting the benefits and applications of IATs.

The contributions of the paper are conceptual in nature. A major contribution is that this paper introduces IATs for the first time in the marketing education literature, and discusses its usefulness in enhancing experiential learning. And second contribution is that it presents a conceptual framework for IAT applications and adoption to support marketing education and discusses how it will be useful to enhance experiential learning in the classroom. The rest of the paper is organized as follows. First, we present intelligent agent technologies and provide a historical perspective and literature review in marketing and related disciplines. Next, we discuss experiential learning and explain how IATs can be used to expand learning and provide related propositions. Third, we provide examples from a marketing research class where students build personal marketing information systems for a class project to access environmental and marketing information in a timely manner. The paper concludes with a discussion on IATs pedagogical support, and provides a future direction of the research.

IATs: Conceptual Background

While many definitions of IATs appear in the literature, their potential and applications in marketing remain to be more clearly understood and adopted. As a result, there is considerable discussion about what an agent is, and how an agent differs from computer programs, in general (Franklin and Graesser, 1997). Various scholars have defined intelligent agents as:

- [c]omputer systems/programs situated in some environment, that [are] capable of autonomous action in this environment in order to meet its design objectives. IATs possess the properties of autonomy, social ability, reactivity, and pro-activeness (Wooldridge, 2002: 15)

- An autonomous entity which observes and acts upon an environment and directs its activity in achieving goals. They have intelligence, or the capacity to learn or generate knowledge, to achieve their goals (Russell and Norvig, 2003)

- Autonomous agents are computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realize a set of goals or tasks for which they were designed (Maes, 1994)

- Intelligent agents continuously perform three functions: perception of dynamic conditions in the environment; action to affect conditions in the environment; and reasoning to interpret perceptions, solve problems, draw inferences, and determine actions (Hayes-Roth, 1995).

Summarizing the above definitions, we find that IATs act autonomously with or without human intervention to solve complex problems; they have the ability to adapt to changing environmental conditions, as well as can accomplish multiple tasks at higher speed. They are not hardwired like traditional software or expert systems to perform specific tasks but rather have intelligence based on logic and learning that enables them to learn user preferences or negotiating strategies. In different situations, they may be either proactive or reactive and can counter the strategies or tactics of others in a dynamic environment.

Finally, IATs can evaluate different scenarios and collaborate to reach optimal solutions. By relying on the notion of virtual machine-to-machine collaboration, and based on common languages or semantics, IATs can form coalitions to obtain, for example, better discounts through virtual group buying situations. Given the above features, IATs are ideal to use in marketing classes. Its ability to adapt dynamic environments and to learn negotiating strategies of users can be effectively used to create experiential learning in classrooms where it can be used as environmental simulations by the students.

Marketing Research Education: A Conceptual Framework of IAT Applications

Use of intelligent technologies in classroom has limited exposure in marketing education literature. Vroom (2007) discusses various applications of intelligent technologies and the need of the managers and students to understand and appreciate what is going inside the 'black box' or the expert system that is handed over to them. Vroom (2007) also stresses the need for understanding what is inside and if possible self-designing intelligent applications based on managerial/student needs. Intelligent technologies have the potential to provide capabilities such as environment scanning, and to interact with users to provide the required transparency and available alternatives, as well as the capability to adapt to user preferences. Thus, it presents an ideal tool for providing virtual environments to marketing students.

Although intelligent technologies have not been discussed explicitly in the marketing education literature, it is acknowledged in the marketing literature. For example, Rust and Oliver (1994) propose the idea of adaptive marketing by using knowledge robots or 'knowbots' that learn from constant interaction between the environment and the various stakeholders. In this paper, we bring this concept to marketing education literature, and suggest that intelligent agents can greatly enhance learning experience of students and facilitate effective experiential learning with minimal cost and we propose it in the context of marketing research training. Thus, we propose a framework for intelligent agent technologies in marketing research education based on search agents, learner agents, collaborative filtering agents, and knowledge and content agents (Figure 1).

Individual Search Agents for Educators and Students

From the educator's perspective, IATs can scan real time information over the web and provide the unmatched and most relevant content to students in real time (Rust and Oliver, 1994). They can also track students' progress in terms of the quantity and quality of content accessed, the time spent on websites, and the time spent on complex problem analysis and solutions. For example, in the case of a marketing research class, the educator may procure a list of relevant websites by using IATs, evaluate the websites, and provide the list to students. IATs can also provide the relationship of economic indicators to relevant sectors and industries, the company in question, competitors, customers and other stakeholders, thus assisting in an up-to-date situation analysis. Marketing metrics information such as market performance metrics (market share, margin and profits, customer profitability), marketing mix metrics (pricing, promotion, sales force, channel), and web metrics (visitors, visits, downloads), can be accessed by intelligent agents to assist educators in their marketing research projects. Moreover, given the complexity of the knowledge environment, it is important for educators to provide clear instructions to reduce cognition requirement for students while using IATs (Hunt, Eagle and Kitchen, 2004). Therefore, we propose:

P1(a): IATs can better facilitate teaching strategies and tactics in the case of complex knowledge environments

P1(b): Role of IATs on teaching strategies and tactics in the case of complex knowledge environments is enhanced if students are provided clear instructor requirements and expected learning outcomes.

Educator Agent
- Learning objectives
- Learning plan
- Learning outcomes
  - Initial assessment
  - Interim assessment and progress
  - Final assessment

Collaborative Filtering Agent
- Fuzzy Rules
- Rating of websites based on number of
  - Visitors
  - Visits
  - Click throughs
  - Citations
- Rankings based on users and

Individual Learner Agent
- Learner profile
  - Learning plan
  - Learning style
  - Habits
- Fuzzy logic
- Goals/progress

Knowledge and Content Agent
- Economic indicators and trends
- Economic Sectors and industries
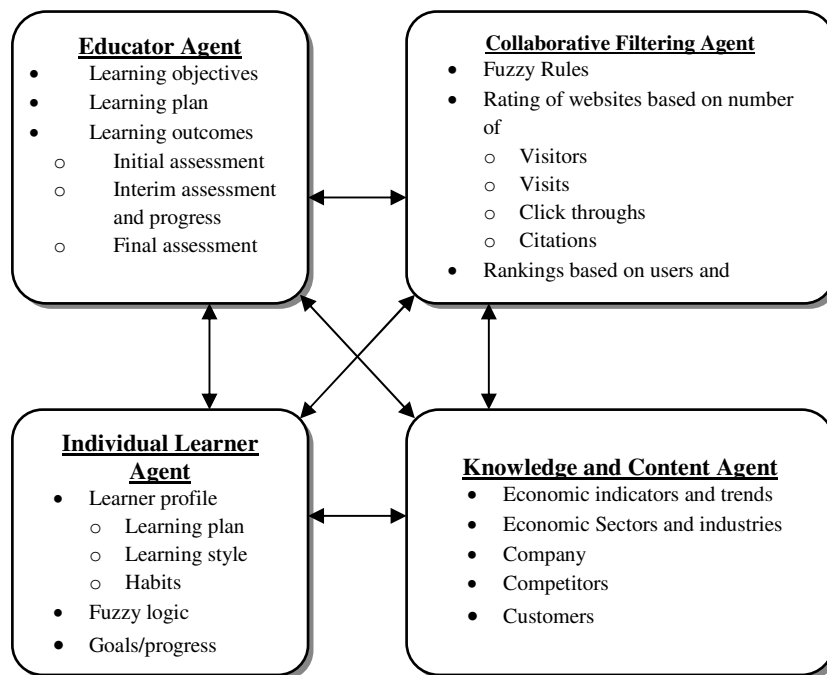- Company
- Competitors
- Customers

Figure 1: Intelligent Agent Technologies for Marketing Research Education

Individual Learner Agents for Student Profiling and Personalization

Different students may have different learning styles and needs. There is a rich literature in Education on learning styles, and the support for 'meshing hypothesis' i.e. linking teachers adaptation to students learning styles to better learning outcomes is mixed in the literature. Various models of learning proposed in the literature include Kolb's model, Honey and Mumford's model, Gregorc's model, Sudbury's model, and Fleming's model to mention a few. Kolb's (1984) experiential learning theory (ELT) model proposes on learning styles based on experience, abstract conceptualization, reflective observation, and active experimentation. A learning style inventory can be created based on the ELT model. Honey and Mumford (1982) expanding on Kolb's research categorize learning styles into activist, reflector, theorist, and pragmatist. The work of Gregorc (1985) categorizes learning styles based on the functioning of the mind. Others categorize learning based on sensory perceptions such as visual learners, auditory learners, kinesthetic or tactile learners (Fleming, 2004). Still other models categorize learning based on styles of thinking, and types of motivations (Jackson, 2011; Sternberg, 1981).

IATs have the ability to adapt to student learning styles and enhance student learning experience and education through offering more reactive environment. For example a student may be very good in conceptualizing the problem, but may need more practical examples, a second student may however need more work on conceptualizing the problem, and a third student may need more support with quantitative analysis. Intelligent agents can adapt to individual student's learning style and thus, can customize the lessons according to individual student's needs. Moreover, a flexible reward system can be built with the IAT to reward students based on their performance and achievements in the environment. Such a system is analogous to a computer game where the player gets rewarded more points for what is more important to achieve in the game, and move on to the next level.

A challenge here is to develop content material for each lesson in a disaggregate fashion but make them related to the learning objectives so that students can interact and learn from the system. The IAT can keep track of various variables such as speed of learning, number to attempts on specific problems, best-suited learning style based on repeated interactions, and provide guidance, directions, assistance and rewards to students as they progress in the learning task assigned. Initial assessments of students' learning abilities can result in designing personalized learning plans, tests, advice etc. that may not have been possible in a traditional classroom setting. Therefore, we propose:

> P 2(a): Student profiling by IATs can enhance learning outcomes by identifying learning styles and areas of strengths and weaknesses for individual students.
>
> P2(b): Student profiling by IATs can enhance learning outcomes by recognizing speed of learning and the retention of concepts by individual students.

Collaborative Filtering Agents

Collaborative filtering refers to the process of identifying patterns or filtering information from multiple sources based on collaboration between agents (Pazzani, 1999). Companies such as Netflix, Amazon.com and eBay use collaborative filtering with great success to recommend books or other items to an active user based on books and items that are used by like-minded group of users. Collaborative filtering models are IATs that are based on data mining and pattern recognition techniques, and can be effectively be used in educational settings to enhance collaboration between different groups such as instructors, researchers, practitioners, and students to recommend books, learning materials, and methodologies (Pazzani, 1999).

IATs can provide recommendations to educators on pedagogy, syllabus, books and other learning materials, assessments based other educators and researchers in the field resulting in a much richer educational and learning environment. Similarly, IATs can also provide recommendations to students on learning opportunities, learning styles, methods, and materials, which they may not be exposed to in a traditional classroom setting or in a online classroom. On the other hand, IAT utilization, however, may face challenges due to information overload, erroneous or incorrect opinions and viewpoints, and semantic similarity of various terms used in different courses and need to be carefully employed. Therefore, we propose:

> P3(a): Collaborative filtering by IATs can enhance learning outcomes by recommending learning materials and approaches to educators and students.

> P3(b): Collaborative filtering by IATs can enhance learning outcomes by recognizing and matching learning material with learning objectives, the educator's style and the student's learning style.

Search Agents for Knowledge and Content

Intelligent agents can acquire information and knowledge by searching domain websites and/or scanning the environment for relevant information (Diehl, Kornish and Lynch, 2003). IATs can not only maintain history of previous searches, but also increase the relevance, reliability, validity, and temporal integrity of search results. They can sort results by various fields to provide flexibility, and enhance queries by Boolean or other advanced algorithms to generate comprehensive and relevant search reports and comparisons and update results in real time. For example, for global and US economic indicators, information can be obtained from domain websites such as those of National Bureau of Economic Research, Bureau of Labor Statistics, Census, US Bureau of Economic Analysis, and the Conference Board. Agents can also scan the environment by scanning websites based on key words and other relevant criteria specified by the user. Therefore, we propose the following:

> P4(a): IATs can facilitate searches or the external environment and provide information to enhance student learning outcomes in complex knowledge areas.

> P4(b): IATs can facilitate searches of the external environment and provide information in cases of dynamically changing knowledge environments and complex applications.

A Marketing Research Project – An Application

IATs can provide the various knowledge creation experiences to marketing research students by not only providing the desired content, but also by acting as a tutor in certain instances. Some of the projects include, automatically scan the environment, and search for economic and market information (for example, economic indicators, market size growth rate, firm size, stock market growth, etc.), keep track of new information or events and inform user of the occurrence, search for competitor information, search for consumer preferences and trends, search for marketing mix information, learn user preferences to provide adaptive information and solutions, provide interactive tutoring of difficult concepts, make autonomous decisions and provide help in user decision making, tutor to solve complex problems, and improve decision-making skills, and so on.

Therefore, in this section, we present an IAT-based marketing research project for students to illustrate the usefulness of this technology. The project described here can be conceptualized to illustrate the use of IATs for environmental screening and gathering of relevant secondary and environmental data. The students will be required to create a personal information management system (PIMS) that will track and update information from various websites and secondary sources of information by using IATs.

Step 1. The project can take a tier approach for information search. The first objective is to scan the economic environment and to identify relevant information regarding the various economic indicators. In the first step, students need to identify economic indicators, to identify web sites that provide information about economic indicators, and to find relevant information and make a rating system for such sites. The objective is to quickly scan the relevant and reliable information from these websites and to synthesize this information to form an overall understanding of the past, present, and future market economic environments.

Information regarding economic indicators is important for marketing research students to get familiar with economic conditions and trends in the market place. Information regarding different economic indicators is released at fixed times; however, the timing is different for different indicators, as well as their information sources, thus making it very difficult to keep track of each indicator.

Furthermore, as economic indicators can substantially influence the market and can have a differential impact on various market sectors, it is important to understand the relevance of the economic indicators to various sectors and industries. Marketing research students and practitioners can benefit by knowing how to interpret and analyze the important economic indicators as they relate them to their marketing research problem. For example, the consumer price index and consumer confidence can provide valuable information to marketers in making marketing mix decisions. Other indicators such as GDP, housing, manufacturing, etc., can also provide invaluable insights to marketing research students about general market trends and their relationship to a certain industry/ company, which in turn, can provide market insight into company, its competitors, consumers, and other stakeholders in the industry. IATs can search leading economics websites based on classifications for economic indicators such as leading indicators (e.g stock market index), lagging indicators (e.g. unemployment rate), and coincidental indicators (e.g. GDP). Web pages can be evaluated by the intelligent agents based on criteria specified such type of domain

(knowledge versus external scanning), currency and relevance of information, credibility of the website and number of references and connections to and from the website, traffic to the website, quality indicators such as source documentation, and third party comments about the website

Step 2. The second step is to gather information regarding the various sectors of the economy and to identify and classify websites that provided information about these sectors. The sector information can be derived from governmental classifications or from publications such as the *Wall Street Journal*. *Wall Street Journal* classifies industries into nine sectors that are listed as basic materials, consumer cyclical, consumer non-cyclical, energy, financial, industrial, technology, telecom, and utilities. Students will be required to identify and classify the websites for one sector per group and to list the strengths and weaknesses of these websites and the information relevance of their content. They will also be required to relate the sector to the economic indicator and discuss what factors could possibly drive performance in that sector or industry. The intelligent agents can learn student preferences and can provide suggestions based on collaborative filtering so that more and relevant information is available to the whole class; not only based on the present students in the class, but also based on the previous students and other similar classes.

Step 3. The third step in the project will be to gain information about the specific company and its major competitors. In the third step, the student groups will be required to select Fortune 500 companies in a given sector that also had a local presence, and to extensively analyze those companies in terms of various factors (for example, trends in revenues and growth rates, competitors, customers, and other stake holders). They will also analyze their market positioning, segmentation and marketing mix strategies and give an overall evaluation of their future in the coming years. Intelligent agents can then distill rules and generate fuzzy rules and logic based on student searches and usage of information sources and web sites. For example, IAT can assign a certain weight on specific company website based on its importance as perceived by the students.

Step 4. A fourth step in the project will be to find information sources and trends regarding consumers relevant to the company's business. Again, the intelligent agents can go to third party websites (for example, consumer reports, and SRI surveys) to find information about relevant consumer and competitor trends and the information can be distilled and stored in a repository.

Project Implementation – An Initial Test

We test the effectiveness of the above IAT based marketing research project with marketing students from a mid-west university. The involved marketing research class was divided into several groups, each dealing with one sector of the economy. All the groups had to identify and classify the economic indicators and sources of information regarding economic indicators that were credible and current. Basic information was provided to students regarding leading, concurrent, and lagging economic indicators.

The students evaluated various websites that were free. A credible source was defined as either the government agency that was the originator for the specific economic indicator, or a research web site that the students had heard of previously and had experience with. Web sites were also evaluated based on third party comments regarding the web site, and the associated quality indicators such as, sources cited, general style and errors. Upon

completion of the project, students were asked to reflect upon their learning experience from the tasks. Almost all students rated this task higher than other non-IAT based projects in terms of its effectiveness, outcome, and outlook. Project information presented to the students are shown in Appendix A.

Limitation and Future Direction

This paper is one of the first in marketing to explore the use of intelligent agent technologies (IATs) for marketing research education. Even though, our work is a first step towards examining the applications of intelligent agents in marketing research education and is exploratory in nature, it advances the theory and contributes to knowledge not only in marketing research education, but also in the field of higher education as a whole. With the recent advent of social networking and innovations such as web 2.0, blogging, text messaging, SMS, and twitter, information and knowledge can be transmitted in real time, thus making it much more accessible, relevant and practical. Furthermore, intelligent agents have the potential to collaborate with students in learning complex concepts, knowledge discovery and synthesis from myriad sources.

Intelligent agents, however, are in their developmental stages and are limited to handle only specific tasks. There are concerns surrounding the flexibility, domain knowledge, and policy issues regarding the applications of intelligent agent technologies in the classroom that need to be addressed. For example, privacy and trust are sensitive issues. As IATs learning about an individual student's strengths and weaknesses, question on ethics have been raised as it may lead to potential exploitation of students.

Our research also suffers from few limitations. First, in this conceptual paper, we develop propositions on how IATs can enhance students' learning. Future research can build on our conceptual framework to empirically test the propositions. Second, in this research, we attempt to develop an outline of how intelligent agents can be used in marketing research education and provide a pathway for marketing research educators to utilize intelligent agent technologies. Therefore, we only implemented generalized IATs that are available in the Internet. Future research is needed on how to design and build IATs based on our research, and use them in enhance students' learning experience.

Conclusion

In an era of second lives, avatars, cloud computing, e-books, kindle, smart phones, twitters and virtual libraries, education in the future is increasingly going to be a combination of human-to-human, computer-assisted and computer to human processes. While theories, complex ideas, and ethical issues as well as designing courses are likely to remain in the human domain, higher education will benefit from the tremendous power of the advanced technologies, the Internet and Intelligent Agent Technologies. Students will benefit not only from human to human interaction with the educators, but interactions with peers over the social networking sites, and intelligent agents that will allow for a widening scale and scope of education by providing more adaption, personalization, interaction, convenience, collaboration and information. Intelligent agents and expert systems will make concepts

easier to learn through adaptive education and one-to-one 24/7 support that are typically available to the students.

Although increased accessibility to online intelligent education is likely to benefit students, policy issues need to be carefully evaluated and designed to avoid misuse. For example, ethical issues remain with respect to testing and experiencing virtual environments that mimic real life. IATs based applications is a new and exciting area of research that has many possibilities. Future solutions, in both the areas of (1) new applications of Intelligent IT in the classroom and (2) the introduction of standards for ethical policies that can protect student privacy while analyzing student use of the new technologies, will allow educators to improve the quality of marketing research education for future business leaders.

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Appendix A: IAT Project Instruction to Students

Assignment (Building your Personal Market Information System PMIS)

One submission per group via blackboard only. Late assignments will not be accepted.

A market information system comprises a set of procedures for gathering, analyzing, and assessing information about a firm's market environment comprised of (1) environment, (2) competitors, (3) customers, (4) suppliers, distribution intermediaries, and sales personnel. Timely market information provides basis for monitoring and estimating emerging market trends.

Your goal for this home assignment is to build your own PMIS using secondary or online sources.

1. Analysis of External Environment: For environmental information and trends you may wish to get information regarding economic indicators as discussed in class. The following link can provide some information http://www.newyorkfed.org/education/bythe.html Which economic indicators do you think are most important for your business/industry chosen in HA 1? Where can you find information regarding these (Online or publications)? What are the trends in various sectors? Where can you find information regarding these trends? a. To analyze look for trends in data for a period of time. Trends can often be more useful than a number provided by a single economic indicator. b. Compare and contrast several leading indicators. Look for apparent contradictions as well as indicators that reinforce themselves. c. Look for correlative factors between economic indicators and the sales for the product/services of your industry/company. d. Find and rate trends for economic conditions (e.g., unemployment, mortgage rates etc) in major markets served by the company e.g., Likely to improve substantially, improve somewhat, no change likely, Likely to worsen somewhat, Worsen substantially. e. Repeat analysis for political analysis. List all sources of information.

2. Competitive Analysis: Who are your major competitors where can you find information about these competitors? Knowledge about competitors is critical for effective marketing research. E.g. how/where will you find information about your competitors' a. SWOT b. Market shares and growth rates c. Products and product line strategies It is important to understand what competition is doing even if you think they are wrong. Identify and prioritize sources of information about your competitors e.g., Newspaper articles, Annual reports, Company literature, other published information. How will you find this information quickly? List all websites in the order of importance. Which ones will you include in your PMIS and why?

3. Customer Analysis: a. Where will you find information about your customers? (List all sources) b. Can you find information by geographical areas e.g., zip codes, how? c. List sources of information regarding innovations, customer trends and drivers for these trends.