

ARE MBA STUDENTS SUFFICIENTLY EXPOSED TO COMPLEX ADAPTIVE SYSTEMS?

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ABSTRACT

During the last decade, there has been an explosion of interest in the complexity sciences. Many research centers and institutes, in the private sector, government and universities, have been created to investigate the enigmatic, emergent properties of complex systems. And, increasingly, organizations are viewed as complex adaptive systems. To date however, there does not seem to be much instruction of these important concepts in U. S. business schools. The purpose of this study was to investigate if this conjecture is true. A World Wide Web survey of some two hundred universities indicated that fewer than ten percent cover complexity topics in their MBA programs. Perhaps, it's time to change that!

INTRODUCTION & METHODOLOGY

During the last decade, collaboration across organizations and across time zones has become increasingly common. This phenomenon, along with the increasing need for sustainable economic growth, has accelerated the development of high performance teams, the reengineering of corporations, the formation of virtual enterprises, and the appearance of loosely structured organizations. All this activity has resulted in complex and messy management situations.

So far, treating organizations as complex adaptive systems (CAS) has led to "scattered successes," and the "accumulated body of such work remains sparse, fragmented, and badly in need of collection and amplification" [2, p. 1]. Nonetheless, the "rapidly expanding discussion about complex systems offers important contributions to the integration of diverse perspectives and ultimately new insights into organizational effectiveness" [4, p. 145]. The CAS point of view *can* help with the management of messy situations. This is because "complexity science and organization science have a common problem they wish to address: uncertainty" [3, p. 119].

Our methodology, for exploring the extent to which MBA students are exposed to CAS theory, consisted of three simple parts. One part was to formulate a comprehensive and detailed description of a CAS based on various, more limited, descriptions found in the literature. Another part was to search the World Wide Web (WWW) for universities, which include some material on CASs in their MBA programs/courses/modules/etc. The last part was to compare the WWW findings with the detailed CAS description and identify the business areas (e.g., marketing, finance, etc.) that cover some CAS material in their courses.

The WWW search went basically as follows: Using various search engines (Google, Yahoo, MSN), we tried to determine if a university had a course or module whose description had phrases or words, which matched our subject matter key words. We examined the two hundred or so U.S. universities listed in the "2003 Full-Time MBA Profiles" found at businessweek.com [5]. Our subject matter key words started with "complex adaptive systems" and were sequentially modified, as appropriate, to include some of the more salient characteristics and properties of CASs -- such as emergence, complexity,

agent-based computations, chaos theory, etc. In a similar way, we also refined the search from the university level down to the syllabus level.

CAS CHARACTERISTICS & PROPERTIES

An integration of various CAS descriptions found in the literature enabled us to formulate a comprehensive and detailed list of the six major characteristics and four macro-properties of complex adaptive systems. The organization of the major **CAS Characteristics** is identical to, but expands upon, that of the Center for the Study of Complex Systems at the University of Michigan [6]. The **CAS Properties (underlined)** are taken from Casti's "myth-shattering" book [1] and integrated into the CAS characteristics listed below:

1. Agents/Elements/Components/Parts. There are usually many agents in the system. They are independent/autonomous and satisfy their own needs. They interact at the micro-level (i.e., locally, in relationships that are short-range), and in many ways (via rules that are often simple, but can also be complex and changing) -- all that, within a particular environment.

2. Heterogeneity. The system accounts for individual differences in the more important attributes of the agents (i.e., average values will not do).

3. Feedback. The interactions/relationships among the agents contain feedback loops -- negative and positive; direct and indirect. The memory of the system is distributed over its parts, and its history is important and irreversible (concept of path dependence).

4. Organization. The agents may be organized into nested structures/hierarchies (i.e., an agent can itself be a CAS and also be part of another CAS). The system is open (i.e., energy/information/etc. can flow in and out -- which alters the cause-and-effect relationships). Its boundaries are not clearly defined. Information/representation is distributed over the whole system. It is decentralized and largely irreducible.

5. Dynamic. The agents can change/adapt/learn/survive/die. The system can change in a nonlinear/non-tractable/chaotic /possibly catastrophic fashion. It is usually far from equilibrium/steady-state. It cannot be completely understood or controlled. It morphs, learns, adapts, and evolves.

6. Emergence. New, coherent, and sometimes paradoxical, macro-level patterns/order/self-organization can appear. This higher level organization results from the micro-level interactions among the agents -- usually at the "Edge of Chaos" (i.e., in the narrow range between stability and disorder).

RESULTS & CONCLUSION

Out of 203 programs, we could identify only fifteen which, during the last five years, offered MBA (or MBA-like) courses containing some CAS topics. These courses are listed, by business area, in Table 1. Of the four **CAS Properties** mentioned above, only three surfaced explicitly. Chaos and Emergence were the most common, but Irreducibility is so fundamental that it must also have been covered. These properties are organized by business area in Table 2.

We believe that the set of universities examined is sufficiently large and diverse to make our findings representative of what does not go on in U.S. MBA programs. In view of the increasing interest in applying the complexity sciences to the management of organizations, a preliminary answer to our question -- Are MBA students sufficiently exposed to CASs? -- is **NO**. Thus, it would seem advisable for many MBA programs to consider including CAS topics in their curricula, while further research via expanded techniques and/or examination of non-U.S. MBA programs goes on.

Table 1. Name and Location of Courses with Some CAS Content

| | MGT./ORG./H.R./OPS./M.S. | MKTG. | FIN. | ECON. |
|---------------------------|------------------------------|-------|-------|-------|
| University of Maryland | | | | 625 |
| Indiana University | Spec. Top. In M.S. | | | |
| Iowa State University | | | | 308 |
| University of Kansas | HP & M 828 | | | |
| Michigan State University | PSY 992 | | | |
| Wisconsin (Madison) | | | | 606 |
| Columbia University | | B6601 | B9301 | |
| Auburn University | MNGT 7890 | | | |
| Clemson University | EDUC. LDSHP. | | | |
| Vanderbilt (Owen) | MT 310 | | | |
| Arizona State University | COMM 691 | | | |
| Texas-Austin | MIS 382N.5 | | | |
| UC Berkeley (Haas) | | | 235 | |
| Naval Postgraduate School | GB 3010; MN 3107; MN 4121 | | | |
| University of Oregon | PPPM 643 | | | |

Table 2. Business Areas vs. CAS Properties Listed in Course Materials

| | IRRED. | CHAOTIC | CATASTROPHIC | EMERGENT |
|--------------------------|--------|---------|--------------|----------|
| MGT./ORG./H.R./OPS./M.S. | | X | X | X |
| MKTG. | | | | X |
| FIN. | | X | | |
| ECON. | | X | | X |

REFERENCES

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- [2] Holbrook, M. (2003). Adventures in Complexity: An Essay on Dynamic Open Complex Adaptive Systems, Butterfly Effects, Self-Organizing Order, Coevolution, the Ecological Perspective, Fitness Landscapes, Market Spaces, Emergent Beauty at the Edge of Chaos, and All That Jazz. *Academy of Marketing Science Review* [Online] (6).
- [3] Lissack, M. (1999). Complexity: The Science, Its Vocabulary, and Its Relationship to Organizations. *Emergence*, 1(1) 110-126.
- [4] Snowden, D., Allen, P., & Goldstein, J. (2004). Call for Papers – Emergence: Complexity & Organization. *Emergence*, 5(4), 144-147.
- [5] www.businessweek.com/bschools/03/geographic.htm
- [6] www.cscs.umich.edu/complexity.html