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The Emergence of a new scientific field: The International Institute of Infonomics

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The International Institute of Infonomics was created in 1999 as a new joint initiative of the University of Maastricht and the Hogeschool Zuyd in Heerlen, The Netherlands. The idea of “infonomics” is based on the belief that new disciplines emerge from time to time based on the interaction between different scientific fields. How this new, multi-disciplinary research area became organized in the International Institute of Infonomics and what kind of teaching activities were developed is what this short note is all about. First a short summary is given of the concept of “infonomics”, and the emergence of new scientific fields. Then a brief overview is presented of the infonomics research programme and the infonomics teaching programme currently offered at the University of Maastricht.

1 Towards a new science of “Infonomics”?

“Infonomics” is defined as the interdisciplinary science investigating the “digitisation” of society. It brings together insights from a variety of fields, covering the liberal arts, the sciences and the humanities, including philosophy, linguistics and law, mathematics, informatics and operational research, and social sciences, such as psychology, economics and business studies. More specifically, infonomics analyses the impact of so-called “new” information and communication technologies (ICTs) on individual and collective behaviour; on learning, cognitive patterns and competence development; on organisational and economic structure and performance; on ethical norms and values and the legal system; on knowledge accumulation and diffusion; on communication modes, democracy and culture. It does so in an interactive, interdisciplinary fashion looking both at impacts as well as feedbacks.

As the digitisation of society evolves, disciplinary fields are being confronted with new research questions and challenges. They have tried to integrate the subject ignoring or downplaying the most contradictory features and

narrowing relevant research questions to the particular discipline. The result has been a rapid fragmentation and overlapping of research and teaching on the subject, each focusing on its own narrow disciplinary relevance. One might even argue that in contrast to what economists have described as the “*general purpose technology*” nature of new ICTs, the study itself of the process of digitisation appears increasingly based on “*narrow purpose research*”. The claim made through the concept of infonomics is that there is a need to bring together the various disciplinary approaches or at least confront them and that disciplinary research in each of these areas is entering diminishing returns because of a failure to recognise the particular systemic nature of some of the changes implied by digitisation.

2 On the emergence of new scientific fields

New scientific fields often develop and emerge on the crossroads of existing disciplinary fields, spurred by the need to accumulate a common body of scientific knowledge to offer insights and explanations for new practical problems. They will often become appropriated fully by existing disciplinary fields and only emerge independently after a long incubation period when the “new” issues or approaches have actually taken over either in research or teaching volume the existing disciplinary field in which they became embedded.

This has been the case, for example, with respect to the emergence of chemical engineering, or electronics and today molecular biology (based on physics, biology, biochemistry, and informatics). The recent case of molecular biology is interesting because it is the only discipline (as accepted today) that was organised at the European level – it was not recognised, even ousted nationally. The EMBL in Heidelberg has been the result. From this perspective, there appear to be major institutional bottlenecks in allowing a new scientific field to emerge. Hence one can observe a complementary need for institutional renewal, which has accompanied the successful and rapid emergence of new science fields.

The co-operation in Infonomics between different university faculties of the University

of Maastricht, research institutes such as the McLuhan Multimedia Institute (MMI) and the Maastricht Economic Research Institute on Innovation and Technology (MERIT) and the professional high schools in the region, the Hogeschool Zuyd, offered the required window of opportunity for such institutional renewal.

3 Infonomics Research Themes

As described above, the word “digitisation” refers to the new, different order of information processing which is being allowed for by *digital* information and communication technologies. Underlying digitisation are at least two technological revolutions. One is the dramatically increased computational power of microchips and the associated programmes (the software) to use that power, introducing the need to redesign all sorts of information processes. The other is the development of digital communication technologies, and in particular the Internet and its empowerment through current World Wide Web technologies, that allow information to be communicated and disseminated in real time, across geographical boundaries. Combined, these two developments confront individuals, organisations, sectors, regions and countries with a transformation of the environment in which they operate, interact and generate value.

These developments, while increasingly acknowledged both in the academic world and in business and policy circles, are still in their infancy. Further developments in mobile communications (mobile internet), man-machine and intelligent machine interactions (jini) within the framework of continuous further development and use of so-called nano-technologies are likely to continue to provide a major impetus to social, organisational and societal change in the decades to come. To some extent we have realised, not by clever scientific design or forecasting, but simply by doing it or rather for most of us, by seeing it happen, that information products have started to lead a life of their own, creating and representing value for end-users, companies or societal organisations alike that is no longer bound to material substrata; a value, moreover, that can be captured by a much larger audience due to the dramatic increase in accessibility. At the same time, information processing and

communication are also changing the value, performance and distribution of traditional, physical products. This continuous expansion process looks increasingly like a never-ending process considering that one is now entering the era of products, physical or informational, that are capable of communicating with each other. However, capturing these various, new forms of added value will still depend, sometimes even crucially, on our ability to add 'tacit' knowledge components, from the creativity of the designer to the experience about limits and possibilities of the medical practitioner.

The common aim of the infonomics research programme consists of the following:

- to understand the value that increasingly consists of information and communication as well as the major changes they have caused in the use and life of traditional products;
- to understand the challenges for individuals, public and private entities;
- to use this new independent or "dematerialised" information, communication and intelligence and the new operational modes they create in order to enhance our lives, societies and economies amongst other things by developing appropriate policy responses including new modes of individual and collective learning.

Five areas of research have been considered.

e-Basics research focuses, in the first place, on the nature of what is exchanged. Not surprisingly, given the variety of disciplinary interest in "digitisation", it contains a substantial conceptual element, as it attempts to sort out the different meanings of notions and concepts as they have been used in different disciplinary settings. At the same time, research focuses on the nature of communication when communication is not just an interaction between human beings but between human beings, intelligent systems and an intelligent global web, hence various aspects of digital "man-information systems" interactions.

One core notion running through the infonomics research programme is that at a very basic level the "atoms" or "units" that are being organised in larger wholes to form society, as well as their interaction, change in a fundamental way in the "informational" society. In the

past, human beings created information and exchanged it with other human beings in rather straightforward ways. Whereas the rise of information systems and networks initially introduced a modification of a quantitative nature, adding intelligence and sensors to reach out to the outside world transforms the basic "units" and their interactions qualitatively. The individual can, as it were, incorporate something of the outside world of other individuals and information systems through a personalised web. The generation of knowledge is no longer a privilege of human beings. And communication and knowledge transfer change nature and require new scientific insights as well as new practical implementations.

The name given to this first research unit reflects then a "back to basics" perspective including contributions from philosophy, linguistics, semiotics and anthropology alongside the traditional fields of communications and information sciences and economics.

The second research area called **e-Behaviour** unit brings one to the behaviour of human and software agents in the information world. How does the individual agent act? How do agents behave in their desire to create or consume information? How will the behaviour of individuals alter because of the different nature of information and communication where personalisation, individualisation and global connectivity go hand in hand? How do these individuals make use of new information and communication technologies to create communities and interact within groups? How can this interaction lead to knowledge building and sharing? How do groups of agents behave and how does the individual agent behave in a group of agents? Human agents have certain abilities, needs and value systems that will influence the way they act and react in the information world. The research sheds light on individual motives, on behavioural patterns, on incentives and strategies in an increasingly digitised, information world. Human communities do exist independent of geographical space. Virtual Communities bring together people with similar interests to build and share knowledge and information, have fun or just to fulfil the need of belonging.

The third research area called **e-Organisation** investigates changes in the

design, production, and distribution of products and services, including those consisting purely of information, under the impact of what people have come to call the “information paradigm”. Whether one looks at an enterprise, a government department, a health care organisation, or for example private households one may discern a number of different trends, which are significantly affected by and of relevance to digitisation. Two major sub-fields are considered under this heading: new forms of “control” or “management” of internal and external resources, operations and relations, and second the “transactions” the organisation is engaged in, coupled with the nature of the “markets” in which these transactions are handled. Fundamental transformations take place in organisations on each of these levels. Management decisions are done in an information rich environment, in which the selection and evaluation of information that is relevant for decision-making becomes critical. Flow of information is no longer determined by the structure of an organisation, where the position of an organisational unit in a hierarchy defines which information is available to it. Instead ICT allows flexible terms of information sharing that enable, or enforce, new organisational structures, like virtual companies and teams. Research carried out under this heading investigates these developments by an interdisciplinary approach. There is a mathematical and computer science component of research that asks for the algorithmic complexity of coordination mechanisms. By an evaluation of actual decision-making in companies with various degrees of ICT infrastructures the correlation between choice of data and models and quality of decision is measured, with the goal to make the value of information determinable. Organisation theory investigates how organisation structures change along with the changes in managing operations. Sociology looks at the evolution of new organisation cultures. Theoretical microeconomics and its offspring Industrial Organisation, as well as experimental and empirical economic research evaluates alternatives of electronic markets in terms of market efficiency and strategies of market participants.

The fourth research area **e-Society** studies the influence of digitisation on the economic, the legal, the social but also the spatial order of

society, and studies also the influence on underlying norms and values. In a very general way, “volatility” characterises the new emerging reality, and so the natural question to ask is: what order goes with volatility? Looking e.g. at spatial order, the relation between digitisation, mobility, urban and town planning shows that we are talking about potentially fundamental and deep-cutting developments. Clearly, adapting or recreating order in societies along these various dimensions will become a new and essential part of policy making. But policies also involve creating the frameworks and rules for individuals, organisations and the political process itself to operate under the new regime. The second general question then is precisely what does this mean for the nature of economic policy, legal policy, social policy, urban and regional planning, to mention but a few, the word “nature” referring to the content as well as to the making of policies. As policymaking has also come to rely extensively on model representations and data supposed to reflect reality, and as it is increasingly doubtful whether the current methods for measuring social and economic activities, and collecting data on them, fully reflect the value transformations (of goods and services as they enter into the standard economic performance indicators, or of companies) brought about by the digital revolution, a sub-field on “e-Measurement” will provide more insights in some of the underlying measurement issues of the digital society. The challenge for the digital society research unit is not just to tackle these questions. Establishing an effective interaction between researchers from different disciplines is as important to catch the full richness of the phenomena under investigation, because at this level scientific disciplines are often deeply entrenched in their disciplinary approaches. Economists from a variety of denominations, researchers in law, political scientists, sociologists, social and physical geographers, are among the experts which will provide input. Although law issues are related to all research units, the largest concentration of legal topics is in this research unit to avoid fragmentation. But legal specialists participate in projects of all research fields.

The fifth research area, called **e-Content** differs from the ones described above in the sense that it focuses on sectoral issues, that is

on the nature of the goods and services which characterise a sector, and on the relations between all parties which play a role in the production and consumption chain. For that reason, it addresses and integrates all aspects of individual, organisational and societal aspects applied to specific content sectors. While the other units devote special attention to the key phenomena at a given level, e-Content research predominantly deals with real-world organisations and initiatives. The request for more applied research is hence more substantial. The overarching paradigm for research under this unit is the sometimes gradual, sometimes rapid change process from traditional, defined and fixed structures into modern, volatile and flexible network environments, and the consequences for content production. The fundamentals of this process as well as the distinct features in concrete organisational settings are analysed and described. A first research track brings together some of the traditional standard setting issues, crucial in a networked society. The more sector based research, is currently based on a policy of prioritisation of research efforts. Initially, the focus is on a cluster of sectors which are at the centre of the new information and communication ‘revolution’, in particular the media, multimedia, culture and libraries (data collections) sectors.

4 Studying Infonomics

The International Institute of Infonomics has not only initiated a number of research activities, it has also set-up new educational programs. The first initiative in this area has been the launch of the study “infonomics” within the faculty of economics and business administration at the Maastricht University. This means that the field of infonomics is being studied primarily from an economists point of view and students will graduate in economics with a specialisation in infonomics. The reason for doing so, is that contrary to research, the labour market for new degrees is still very much traditional: students will be judged and find employment on the basis of their core discipline affiliation. Furthermore economics offers a number of opportunities to “house” a new specialization such as infonomics.

Economists have indeed known for a long time that information is a very different product from traditional material goods or services. Thus for economists information has particular characteristics: it is not made of scarce physical resources; its production, distribution and multiplication might require some, but not much energy; it can be copied infinitely; it can be tailor-made to suit individual customers but it can equally be “disowned”. Nevertheless and implicit in the concept of Infonomics is the need for an interdisciplinary approach to such information economics issues, including legal issues about intellectual property and privacy, informatics with respect to electronic information management and resource planning, and even broader psychological and societal features linked to a better understanding of individual and collective behaviour in virtual environments. The new Infonomics study programme hence appeals to economics students with a broad multi-disciplinary interest.

Three particular features are currently popular with students following the Infonomics teaching programme. First, the guarantee of having obtained an economics degree from the Faculty of Economics and Business Administration of the University of Maastricht, one of the best if not the best economics and business department of the Netherlands. Second, the fact that the Infonomics programme covers also other, non-economic fields, and hence corresponds to a growing need for broader educated economists. Third, the particular Internet and WWW skills students will have acquired making them probably more digitally skilled and qualified economists.

More general information about Infonomics and the International Institute of Infonomics can be obtained at <http://www.infonomics.nl>.

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