

Interdisciplinary Research - Challenges and Opportunities for Actuarial Profession ¹

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Reference number: 57

Track: Education and Professionalism

Abstract. In recent years more and more attention is paid to interdisciplinary research (IDR) and its possible impact to development of sciences. Phenomena and problems that nowadays researchers must investigate are usually too complex to be fully described within context of a single discipline. Actuarial profession is highly interdisciplinary in its origin so now it faces new opportunities (as well as challenges) for further development. Though principles of interdisciplinary research are applied more and more there is still no unique definition what it is. Some most popular definitions are presented in this paper as well as main advantages and disadvantages of IDR. Possible challenges and opportunities for actuarial profession are discussed.

Keywords: Actuarial education; Actuarial profession, Interdisciplinary research

¹ This research was inspired by participation in project Baltic Mobility 2 (Baltmob2), supported by Estonian Academy of Young Scientists (2008).

I. Introduction.

There is no doubt that interdisciplinary research becomes more and more important. However, it is neither easy to find exact definition of interdisciplinarity in scientific literature nor it is possible to say when first attempts to merge methods of different disciplines took place. Nice generalization of various minds is given by J.T. Klein (Klein 1990): *“For some it is quite old, rooted in the ideas of Plato, Aristotle, Rabelais, Kant, Hegel, and other historical figures who have been described as “interdisciplinary thinkers”. For others it is entirely a phenomenon of the twentieth century rooted in modern educational reforms, applied research, and movement across disciplinary boundaries”*. Summarizing what is said above author (Klein 1990) states that: *“The actual term did not emerge until the twentieth century (.....). However, the basic ideas are quite old (.....)”*.

Not only the term “interdisciplinarity” is quite new, but also one may find in scientific literature slightly different terms with a bit different meanings – multidisciplinary, interdisciplinarity and transdisciplinarity (as well as some others). Usually **multidisciplinary** is regarded as *“faculty from different disciplines working independently on different aspects of a project”*, while **interdisciplinarity** as *“faculty from different disciplines working together on the same project”* (see, for example, Mallon and Burnton, S. (2005)). On the other hand, **transdisciplinarity** *“is the application of theories, concepts, or methods across disciplines with the intent of developing an overarching synthesis. (...) the theories, concepts, or methods are not borrowed from one discipline and applied to another, but rather transcend disciplines and are therefore applicable in many fields. The disciplines do not contribute components, but rather provide settings in which to test the transdisciplinary concept, theory, or method”* (Lattuca 2003). It is worth noting that there is no unique definition of above mentioned terms in scientific literature, so different authors may use slightly different definitions. However, it is obvious that “multidisciplinary” is usually understood as “first step” when the same phenomenon is studied from different perspectives by researchers from different fields. For example, problems of AIDS are investigated separately by physicians, public health specialists, politicians, actuaries (actuarial models) etc. Results achieved in one area are usually not applicable to other scientific areas. Multidisciplinary research may or may not lead to interdisciplinary approach but it is very unlikely to have interdisciplinary research without previous results achieved as part of work of multidisciplinary team. On the other hand transdisciplinarity is regarded as “highest” stage in merger of disciplines. We will neither address multidisciplinary nor transdisciplinary approach in this paper.

Our paper is organized as follows. Concept of interdisciplinary research and some popular definitions are presented in section II. Section III addresses main advantages and disadvantages of interdisciplinary research compared to traditional monodisciplinary research. Possible impact of interdisciplinary research to actuarial profession is discussed in section IV.

II. Concept of interdisciplinary research.

There is no unique definition of Interdisciplinary research (we will also use abbreviation IDR) in scientific literature. Sometimes term IDR is used in very broad sense (e.g. IDR is when elements of any two disciplines are used in research process) while sometimes descriptions may be very specific. Let us look at some mostly representative definitions. So, for example, G. W.

Blackwell (1955) states that truly multidisciplinary research team must satisfy three basic characteristics – 1) more than one researcher must be involved in the investigation process; 2) these researchers must represent at least two disciplines and, finally, 3) at least some degree of collective work must be present, so researchers must work as a team and not separately. However, later in article author (Blackwell 1955) points out that between two limiting cases of research – lonely researcher working in one discipline and multidisciplinary team research (two or more researchers working as team and combining different disciplines) – there are numerous cases when some elements of interdisciplinary research are present:

- *Lone researcher using more than one discipline*
- *Two or more researchers working separately in same discipline*
- *Two or more researchers working as team in one discipline*
- *Two or more researchers working separately in different disciplines.*

Another quite reasonable definition of interdisciplinary research is given by P. Birnbaum (Birnbaum 1981). He states that: “*Research teams which possess all of these eight attributes are purely interdisciplinary:*

- 1) *Different bodies of knowledge are represented in the research group*
- 2) *Group members use different problem solving approaches in attempting to solve problems*
- 3) *Members of the group perform different roles in solving problems*
- 4) *Members of the group work on a common problem*
- 5) *There is group responsibility for the final product*
- 6) *The group shares common facilities*
- 7) *The nature of the problem determines the selection of group personnel*
- 8) *Members are influenced by how others perform their tasks”*

Both above mentioned definitions clearly presume that more than one researcher must participate in investigation. However, it is easy to notice that points 3) – 8) in the last definition (Birnbaum 1981) are typical for any team working on any problem not necessarily interdisciplinary. Moreover, nowadays there is absolutely no need to require the group to share common facilities (point 6)) since modern computer technologies allow team to work effectively even if physically members are located in different cities and even countries.

The typical question regarding IDR may arise: “if one single researcher possesses and uses in his research concepts, paradigms and knowledge from different disciplines, may we say that such research is interdisciplinary in its origin? This may happen when, for example, statistical methods are applied to medicine, biology, sociology; concepts from mathematics and economics are merged in order to explain behavior of insurance markets and in many other areas. Indeed many modern definitions of IDR stress more on tools, methods, models used rather than on number of persons involved. So, for example, Tijssen (1992) states that research is interdisciplinary if it involves “*direct or indirect use of knowledge, methods, techniques, devices (or other ‘products’) as a result of scientific and technological activities in other fields*”. Porter et al. (2006) went further in this direction and relied on research fields and not disciplines, authors proposed that: “*Interdisciplinary research (IDR) is a mode of research by teams or individuals that **integrates***

- *Perspectives / concepts / theories **and/or***

- *Tools / techniques and/or*
- *Information / data*

from two or more bodies of specialized knowledge or research practice. Its purpose is to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single field of research practice”.

Challenging definition of IDR is presented by P. J. Beers and P.W. G. Bots (see Beers, Bots 2007): *“The project becomes ‘interdisciplinary’ only when this new scientific knowledge is such that it could not have been produced if the participating researchers would all have had the same disciplinary knowledge. In other words, if we have a small multidisciplinary project with researchers a and b, trained in disciplines A and B, and individually capable of producing new knowledge K_A and K_B , this project becomes interdisciplinary when it produces knowledge k such that $k \notin K_A \cup K_B$, so for k to be new, it should involve knowledge not already part of disciplines A and/or B”.* Requirement to produce knowledge not already part of disciplines involved in research is very strict, moreover it is very difficult to say whether new knowledge is not a part of any discipline (involved in research) since traditional boundaries of almost all disciplines are expanding very quickly. However, first part of last definition (*“knowledge is such that it could not have been produced if the participating researchers would all have had the same disciplinary knowledge”*) describes very clearly the main goal of IDR. The same concept is also present in Tijssen’s definition given above. Indeed, it is obvious that expected results should drive and be main reason of IDR and not just “pure technical” usage of elements from another discipline. Integration of methods, techniques and / or data from different fields should be used solely and exclusively for goal achievement and not because it is “fashionable”, “modern” “is capable to attract more funds” and so on. Therefore in the quite broad sense we will use term “IDR” speaking of about any activity which main goal is to achieve results which would never be produced otherwise (if concepts, methods and / or techniques from only one discipline would be used).

III. Interdisciplinary research – opportunities and possible threats

Abundance of different definitions of IDR shows how significant this concept is in development of modern sciences. Main advantage of IDR was already mentioned – to achieve new results which would never be achieved otherwise. However, interdisciplinary research faces many potential threats and has some disadvantages compared to traditional monodisciplinary research. Main disadvantages and threats are closely related and sometimes even stems from main advantage of IDR. In this section we will list and discuss some basic obstacles that may be faced by researchers working in interdisciplinary area, mainly:

- **Time and effort.** Compared with “traditional” monodisciplinary research IDR is, by no means, more time and effort consuming.
- **Cultural differences.** These are unavoidable so participating researchers must be able to work in “multicultural” environment.
- **“Quality” of results achieved.** Results achieved (at least at the beginning of research) may be trivial when considered from viewpoint of participating disciplines so this circumstance may prevent researchers from being involved in IDR.
- **Tool or goal.** Employment of IDR must be predetermined by its goal and not by the simple desire to use IDR for whatever reason.

We will discuss each of above listed obstacles in more detail. Probably, everybody will agree that time and efforts needed for interdisciplinary research are indeed much greater compared with traditional monodisciplinary research. However, results achieved may significantly exceed resources used so this point should not be considered as main threat to IDR.

Considerable greater difficulties arise when we speak about merger of methods (concepts) from different disciplines. We may view each discipline (sometimes just one research field) as different “culture”, that is each discipline has its own “thought patterns” (paradigms), uses specific terms (including but not limiting to jargon and abbreviations, for example, IBNR, UPR etc.), has different traditions how to technically present results (sometimes results are indeed the same), different notation for same or similar objects or phenomena’s. So, many problems that researchers in IDR area must deal with arise mainly from cultural differences, for example (see also, for example, Bauer 1990, Locker 1994 and references therein):

- Disagreement about what data is relevant
- Discord about what research method is best and mostly convincing
- Misunderstanding of terms (differences in meaning of the same word)
- Methodological mistakes when applying methods from other fields
- Communication problems
- Ethical issues and many others

So, doing interdisciplinary research resembles working conditions in multinational (multicultural) environment very greatly. Those who have visited foreign country even for very short time may remember misunderstandings or even incidents descending solely from different cultural habits. The same may happen in IDR too and sometimes only goodwill and strive for cooperation from all parties involved may lead to successful cooperation. Ability to explain what you mean to representative of other profession (communication skills) are of extreme importance, since without understanding what is really said no further cooperation is available. Nice generalization is given by P. J. Beers and P.W. G. Bots (see Beers, Bots 2007): “(...) *a and b (researchers – comment by author) initially each speak their own disciplinary ‘languages’ A and B, and to achieve common ground, they must each discover what they have in common (i.e., $A \cap B$) and extend their language to $A+C$ and $B+C$ where C consists of the concepts needed to better understand the empirical phenomenon they investigate*”. Bauer (1990) points that: “*Some languages support concepts that are simply not available to others (...). The sociologist cannot really understand what the scientist means by “objective”; and the scientist cannot understand how the sociologist can think of knowledge as “constructed”. Just as in languages the vocabulary cannot be entirely separated from the grammar, the syntax, or indeed the national culture, so in the disciplines “knowledge” cannot be isolated from the conjugate methods, the theories, or indeed the history and practice of the field*”. From citations given above one may conclude that effective communication – though usually not examined in any university – may be of extreme importance for successful interdisciplinary research.

One more difficulty that IDR will inevitably face – “quality” of results achieved. It may happen that results achieved (at least at the beginning) will be very simple and even trivial or insignificant when considered from perspective of any participating discipline. Moreover since main goal (of IDR) is to achieve new results (knowledge) that is not already the part of any discipline involved we may end up with situation when new results are not “recognized” by any

discipline and therefore activity of researchers involved will be treated as “unsuccessful”, “unproductive”. If salary of researcher and / or other his (her) financial benefits will depend on academic results achieved, he (she) most probably will not even consider opportunity to work in interdisciplinary team. One more aspect of this problem – researcher representing one discipline (say, A) would like researcher from other discipline (say B) to help him to achieve solely results from discipline A, however, proposal to work in interdisciplinary team on common problem may lead to rejection, mainly due to “estimated” poor quality of results achieved in first stages of common work.

Another - opposite – problem may be tendency to use IDR more as a tool but not as a goal. Suppose, chances to get financing for research are increased if results will be interdisciplinary. This may force applicants to involve at least some elements of IDR even if there is absolutely no need. Indeed IDR may be very powerful tool used for achieving new knowledge but only if it is used properly.

IV. Interdisciplinary research and Actuarial profession

Though this is not officially declared actuarial profession may, by no means, be characterized as “area of interdisciplinary research”. This trait of actuarial practice may be noticed from almost very onset of our profession. It is well known (see, for example, H. Bolnick 1999; I. Chatzivasiloglou, Ch. Fytros 2006) that already during 17th century actuaries applied principles of probability theory and statistics to calculation of premiums and reserves for life insurance company. Later on, during 19th – 20th centuries actuaries moved to new areas of practice, such as pension funds, investments, social insurance and many others thus creating further opportunities for cooperation between various disciplines. Though economic conditions changed dramatically (comparing with 17th century) one of the main problems faced by life insurance companies is (still) “(...) a fiscal one: making provisions for the life insurance company to maintain adequate reserves and capital to fulfill its contingent promises when they come due. This central problem must be solved taking into account both external contingencies (for example, mortality, lapses, return on investment) and internal contingencies (for example, management’s competence and its trustworthiness)” (Bolnick 1999). It is very unlikely that one person will possess all necessary skills needed so cooperation between specialists representing different disciplines (mathematics, economy, demography etc.) is of primary importance.

Some shift towards interdisciplinarity may be noticed when we analyze changes in syllabus of actuarial education (see Panjer, 2006). So, in 1975 syllabus of actuarial education consisted of mainly “mathematical” subjects - Mathematics: algebra, trigonometry, geometry, calculus; Probability and statistics; Compound interest mathematics; Life contingencies; Construction and graduation of mortality tables. Some applications such as Life insurance, pensions, social insurance, and health insurance also were included. In 2005 new subjects such as Economics, Applied Statistics, Risk theory, Introduction to actuarial practice (applications); Design and pricing of products (nation specific); Employer / sponsor perspective were added to syllabus thus reflecting changes towards interdisciplinarity in working environment of actuary.

According to survey carried out by Society of Actuaries employers think that besides professional knowledge other skills are important for actuaries, such as (Ch. Daykin, C. Lyn, M.T. Palandra 2006) – “*Effective communication; Innovative thinking; Appreciation of business*

context and general business acumen; Leadership". Moreover, authors state that *"business design is incomplete if it does not take into consideration how the human element interacts with the business model. Should psychology, sociology and behavioral economics play a bigger role in the education of actuaries"*? And given answer is: *"probably so, but the syllabus for qualification is already overloaded"*. Ability to apply principles of interdisciplinary research may be excellent alternative to extension of education syllabus.

The need for broad minded professionals rather than (even very excellent) technicians is obvious in nowadays insurance (and not only insurance) markets. Actuaries are supposed to possess brilliant statistical skills, so it is good idea to look what capabilities are required by statisticians. Purely statistical training is no longer enough neither for statisticians working in industry nor their colleagues engaged in governmental activities. *"Industry needs – perhaps more than it ever has – nimble problem solvers with first – rate statistical skills. Solid statistical thinking is required for integrated solutions to many of industry's toughest problems. Statistical training should be truly holistic because that is the way statisticians are expected to operate in the real world"* (J. R. Kettinger, "What Industry needs", 1995). *"In recruiting, we look for statisticians that are persons for all seasons. We would like an applicant to be able to do everything and be a specialist in everything (...). But I doubt that being both a universalist and a specialist is possible. (...) The most important thing I would like to see is people emerging from graduate school understanding that they are going to play on a team, and knowing how to communicate in that team setting. (...) Having experience in teamwork is very important, especially with respect to communications. We want people who can communicate easily and across disciplines, and who will have the other team members understand what statisticians are trying to tell them."* (N.P. Ross, "What Government needs", 1995).

There is no doubt any more that actuaries must be prepared to work in interdisciplinary environment. So called "transferable" skills (including but limited to – effective communication, team work, time and project management) are important as much as is purely "technical" skills. It is good idea to start develop these skills already in universities (for example, in Vilnius university bachelor papers are prepared by teams of 2-4 students) however it is obvious that it is too difficult to examine whether actuary is prepared to work in interdisciplinary environment and – if yes – how developed his / her skills are. So, most probably responsibility for development of above mentioned skills should be left to actuary, while local and international actuarial organizations may help, for example, by providing relevant training and consultations.

There is no doubt any more that actuarial profession must accept challenges caused by merger of disciplines and "interdisciplinization" of research practices. Competition from other disciplines – econometrics, statistics, risk management – is increasing greatly and some jobs earlier carried out solely by actuaries may now be fulfilled by other professions. Effective employment of principles of interdisciplinary research may help actuarial profession to withstand challenges of constantly changing business environment.

V. Conclusions

Interdisciplinary research becomes more and more important. Though there is no unique definition of IDR, most often it is considered that IDR must integrate principles, methods and / or data from at least two disciplines. Main goal as well as benefit of IDR – it helps to achieve results which would never be achieved if participating researchers would share the same

disciplinary knowledge. Actuarial profession is highly interdisciplinary in its origin. Effective involvement of principles of IDR in actuarial research may benefit greatly for further developments of our profession.

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