**BEYOND PH.D. – WHAT NEXT? PUBLISHING, NETWORKING AND RESEARCH TRADE-OFFS
IN RELATION TO PLANNING YOUR CAREER**

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ABSTRACT

A Ph.D. in simulation offers many possibilities for a further career. Examples of popular job types for simulation researchers are analyst or researcher in a public or private organization, consultant, entrepreneur, and Post Doc or researcher in a university. During the Ph.D. research, it is very well possible to prepare for the desired career path. The trade-off between applied research and theoretical research can be managed to provide a good starting point for the chosen type of job. The types of publications and research outlets can also be aligned. Independent of the job, methodological soundness, a good theoretical foundation, and validation of concepts and models are key to success. The paper will provide several guidelines for publication strategies adapted to the job type, as well as a networking strategy to help you link to the right people.

1   SIMULATION RESEARCH

Simulation research is often multidisciplinary, and most Ph.D. researchers in simulation have to strike a balance between their theoretical contribution and their contribution in an application domain. Even when the main focus of research is on a contribution to the simulation field itself, the theoretical concepts still have to be tested. Because simulation is often applied to solve complex problems, it is often not sufficient to use simple 'toy' cases for testing. Therefore, simulation researchers often have to test their new theoretical concepts in a real-world setting. The reverse route is also possible: starting with a real-world problem, e.g. in logistics, transportation, or the health care sector, for which a new simulation method or tool needs to be developed. Often the problem instance is representative for a large class of problems in order for the research to be interesting. Generalizability and validity, both of the models and the methods remain at the core of good simulation research.

2   JOB TYPES

Simulation Ph.D. students have a wide variety of jobs for which they apply. Not all prepare for an academic career, and many use the Ph.D. research to prepare for a career in the private or the public sector, or start their own company, often based on the insights gained during the Ph.D. research project. Some of these jobs are more research related, some are more domain related, and some are totally unrelated to the simulation field and the application domain. Depending on the expected job type, a lot can be done during the research to prepare for the expected job. A number of examples, some obvious, some a bit less obvious, are given below for a number of job types. See also Paul (2007) for tips for becoming a good researcher.

2.1   Academic career

Many Ph.D. students prepare for an academic career with their research. A successful academic career starts on day one of your Ph.D., or even earlier. There are some tips below that can help you increase your chances on the academic job market.
    Publish, publish, publish. Your choice of publications, the publication outlets, and the content of the publications can make a lot of difference in how big a help these are for an academic career. Some general guidelines for publishing are given in section 4. In general, journal publications help more than conference publications. A good strategy for each paper is to first publish at a conference, and then expand the paper to fit a journal. Look at the journals and conferences that are important for the academic field you want to work in, and try to publish there as much as possible. Don't immediately aim for the highest rated journals, as they usually demand concrete research results that are not present yet at the start of the project, but do build up your publications aggressively. Learn from reviews from rejected papers and comments for major reviews.

Build your academic network. You have to start thinking quite early in your career what you want to be known for in your field – this can be a simulation specialty and/or an aspect of an application domain. See what keywords are connected to this specialty, and actively search the paper databases and Ph.D. databases to find the key publications in your field. Use the conferences to build up relationships with other institutions and with the relevant specialists from all over the world. Make a network analysis on the basis of the key papers for your research. In other words, which people and which institutions are the most active ones in your field? When you have identified the key people, you can try to build a relationship with them at conferences or through e-mail. Actively connect to these specialists at conferences and workshops. See if you can get some of them to briefly review one of your papers. If they express genuine interest in your topic, you can see if they are willing to co-author a paper with you.

Be active in professional organizations. Choose one or more organizations that represent the field you are working in. Become a student member, read the publications, and see how they can help you build your career. Many professional organizations have student chapters, and many organize career events, such as job interviews during conferences. Examples of professional simulation organizations with their emphasis can be found in Table 1. Many other professional simulation organizations exist; a good list can be found at <http://www.scs.org/msnet/links.html>. In addition, professional organizations exist for every application domain. When your research emphasis is on applying simulation, you should select one or more key professional organizations for your application domain as well.

Table 1: Examples of professional organizations in simulation

Organization	Focus and specialties	Website
SCS: Society for Modeling & Simulation International	General simulation society. Organizes a substantial number of conferences on simulation world-wide. Publishes two journals (Simulation, Journal of defense Modeling and Simulation) and a magazine. Good resource for simulation in general.	<www.scs.org>
INFORMS Simulation Society	INFORMS is the Institute for Operations Research and the Management Sciences. If your research focuses on OR/MS or your application domain does, this is a good society to consider. Publishes several interesting journals (e.g., Interfaces, JOC), organizes large conferences and small workshops, and has local chapters and student chapters. Offers career development support.	<www.informs.org> <www.informs-sim.org>
EUROSIM	EUROSIM is a federation of European simulation societies. It organizes a large European conference every three years. It publishes one journal (SIMPRA) and a newsletter. You become a member of EUROSIM through the national simulation society, and have access to a wide set of resources.	<www.eurosim.info>
National simulation societies	Many countries have a local simulation society. Most of the European ones are part of EUROSIM that was mentioned above. National simulation societies provide a good link to local simulation professionals and career opportunities. Local workshops are cheaper to attend and can provide contacts to local researchers as well as local simulation professionals.	A list is available at <www.scs.org/msnet/links.html>
ACM SIGSIM	SIGSIM is the ACM Special Interest Group on Simulation and Modeling. It offers broad support for the simulation field. As ACM is the Association for Computing Machinery, the society is especially of interest when you work on simulation tool development, or apply simulation in the computer science or telecommunications field. SIGSIM publishes the TOMACS journal. ACM offers many career support options.	<www.acm.org> <www.sigsim.org>
ISAGA	If your research in simulation links to the gaming field, ISAGA, the International Simulation and Gaming Association might be an interesting society. ISAGA organizes an annual international conference, and it publishes the Simulation & Gaming journal. The forums offer opportunities for look for job openings. ISAGA has several affiliate organizations.	<www.isaga.info>

Invest time in service to society. Indicate that you want to review for the conferences you have actively participated in. Make good reviews and show that you are eager to contribute. This also helps to build your network. As a result, you might be offered to review papers for journals as well, and some Ph.D. students even succeed to get on the editorial board of a journal close to finishing their Ph.D.. Being on the organizing committee of a workshop or conference is also very helpful. Your name is then connected to a professional organization, and the professional role in the conference will enable you to directly make contacts with (potential) participants such as keynote speakers, editors of journals, and high-profile researchers.

Start early with involvement in education. This depends a bit on the country and university culture, but usually it is considered to be an asset if during Ph.D. research you were already involved in teaching, lab activities, and coaching of students. Students can also be an asset for your research, as they can help gather data, carry out analysis activities, and test research ideas in multiple cases. Especially in case based and action research, it can be an asset to have someone else than the researcher carry out a number of tests, as this guarantees some independence from the researcher himself or herself. When you pursue an academic career, you will be involved in teaching anyhow, and you can better learn sooner than later. This also works the other way around; if you really don't like the teaching and the involvement with students, you might reconsider your options.

2.2   Analyst in the private or public sector

If you are sure you want a job in the public or private sector, this is quite different from an academic career, and it asks for a different approach. Usually, the application domain of your research and the empirical results provide a link to the network of potential employers.

Choose the right research methodology. If you are able to influence the research method used, try to apply a case study research method (Yin 2003), or action research (Argyris et al. 1982, Baskerville and Wood-Harper 1996, Greenwood and Levin 1998). When applying action research or a case study strategy, you study a phenomenon in its natural context. As simulation models are often applied to help understand a real-world situation, the case study methodology is often applied in simulation research. This guarantees a close connection with the real-world issues and it allows you to have direct contacts with the organizations involved. Action research can be seen as a subset of case study research, where direct intervention (action) is used to develop a theory (method, tool) or to test the theory in practice. Because the researcher directly intervenes with the system that is studied, there are some restrictions on how to carry out the research in a solid way. The developed theory, method or tool can be an innovation in the simulation domain (tested empirically in an application area), or an innovation in the application domain (using simulation to test its applicability or effectiveness). At any time in the research, you have to be aware whether your innovation lies in the modeling and simulation domain, or in the application domain.

Select your case studies carefully. Your case studies are an asset for your future job. They allow you to build practical experience in one or more companies. If you select your case studies wisely, they can provide a good introduction to potential employers. Generalized research results from your case studies can later be applied in other companies as well. When you can carry out a case study at one or more interesting companies, the experience and contacts will be an asset for your further career.

Build your company network. Contacts with companies and a set of business cards of people you know and who know you is very valuable when you continue your career outside the university after your Ph.D.. Use every opportunity to present your results to companies. Carry out projects with students in companies to make contacts, and do the best you can to relate the student projects to your area of interest. Establish personal contacts with the employees of the organizations. It can also be useful to make contacts with alumni of the university, who are working in organizations of interest.

Visit applied conferences and trade shows. One way to build your network is to present at practical and applied workshops or conferences. Usually, you use your application domain rather than the simulation field to search for these workshops. In your presentation, show that your research is sound, but reserve a considerable part of your paper and presentation to the discussion of your results and practical contribution. In other words: show what issues, problems or opportunities you address with your research and how your novel simulation approach will help.

Focus on your empirical results. When you pursue a job in the public or private sector, it can help to demonstrate that your theory, method, approach or tool really works in practice. So, rather than relying on laboratory experiments or theoretical verification of your work, gather empirical evidence that your contribution works in practice as well. To do this convincingly is quite hard. For your research, you often need to base your arguments on a sound statistical or mathematical analysis of your empirical results. Although this is absolutely needed for your dissertation, the mathematical analysis is not always convincing for the organizations you work with. In that case, also look at the possibility to create a business case around your results, to convincingly demonstrate the practical applicability of your results to the organization. In the later part of your research, see how you can generalize from your case studies and make a more general contribution to a wider set of organizations than just the ones where you carried out your case studies.

Publish in your application domain. Of course you have to publish your results in the best modeling and simulation journals if you can. You can follow the tips in section 4 to help you with this. In addition to the simulation journals, find the best journals in your application domain, and potentially some trade journals where you can publish the practical results and business case for your contribution.

2.3   Entrepreneur

Many Ph.D. students start their own organization after successfully defending their thesis. When you want to start your own company that is related to your area of Ph.D. research, you can increase success if you carefully consider a number of issues.

Focus on your innovation. Your innovation and what you learn during the time you are a Ph.D. student are huge assets for starting your company. Therefore, it is important to create the business case around your innovation as much as you can already during the Ph.D. work. The more complete your innovative work is, the easier it is to transfer it to a new company. Make a business plan for the company, and relate the innovation to your business plan. It is not always easy to ensure in the business plan that your Ph.D. results can lead to a profitable company. There is a huge difference between demonstrating that something works, and turning it into profit. Therefore, you have to plan ahead and see how your work can add value for your company.

Develop a solid testing strategy. The better you test your results, the more convincing they will be. For some types of research It could be interesting to broaden the types of tests you carry out. An example for a newly developed simulation method or tool is to not only test just whether it works, but also how potential users value its usability and usefulness. In that way, you learn something about the potential transfer to industry and about the pluses and minuses when selling the research results through your company. Examples of testing strategies that examine the applicability of your results are TAM – the Technology Acceptance Model (Davis 1989), VFM – the Value Frequency Model (Briggs 2006, Briggs et al. 2007), and SUMI – the Software Usability Measurement Inventory (Kirakowski and Corbett 1993). For software applications, Nielsen's heuristics (Nielsen 1993) for usability are often used. A good set of references for software usability, which can also be applied to model usability, can be found in Seffah et al. (2006). In addition, there are many testing strategies available that are related to the application domain you are working in. It is extremely important to apply the right testing strategy in your domain, and to design your testing strategy very early in your research.

Publish about your inventions. In your publications, focus on the innovative aspects of your research, thereby claiming some ownership of the inventions. This means that you have to carefully think about what's new, and consistently work on improving the innovative aspects of your research and include these in your publications.

Research the ownership of results. When you work for a university or research institute, the ownership of results is often with the employer and not with the individual researcher. So sometimes it is quite difficult to exercise your rights for the research results. If you do practical work, the organization where you do your case study might make it difficult for you to use their application as a showcase for your company. NDAs (Non Disclosure Agreements) and IP (Intellectual Property) documents are often an integral part of carrying out a case study. When patents for the work are filed, this is often done on behalf of the employer and/or the client of the research. It is still the researcher who often applies for the patent, but to grant or transfer the patent to a start-up of an former employee usually involves a hefty fee. One solution that researchers often use is to put as much of the results of the research into the public domain as possible. This means development on open platforms, using open source software and public domain libraries. In that way, the research results can easily be taken into a company after completing the Ph.D. work. As the prime researcher, you still have the advantage of being the developer, which means that you can apply the developed tools, models, theories, and methods usually easier than anyone else.

Build a professional network. Start early with your company business plans, so you can already make contacts to potential clients, suppliers, and developers while still carrying out the research. But do be careful to stay 100% loyal to your employer and to your supervisors. Be always fully open about what you do, and think about the consequences if you start early with building up your company and clientele. Trade shows can be a great way to meet with potential clients and other companies. It is also good to see what the competition is doing. Trade journals are another source of information about the market and competition. Setting up a good system of business contacts and managing that network is extremely important. Actually this is also important for other types of jobs; the nature of the contacts will be different for each type of job.

Use the available resources for start-ups. Many universities have special courses for entrepreneurs, and offer services for start-ups, such as help in writing business plans, cheap company accommodation, and sometimes financial support. As long as you are registered as a Ph.D. student, you can usually use the services and participate in the entrepreneurship courses for free.

2.4   Consultant

Consultancy is a quite logical step after a simulation-related Ph.D.. Simulation often involves a problem solving activity, and in many cases, it brings you into contact with organizations who are looking for answers that they could not find themselves. Therefore, as a simulation specialist who works on a practical problem, you almost automatically develop some consultancy skills. If you want to continue working in the consultancy world after your Ph.D., it is good to build on these skills during the Ph.D. research, which is often possible.

Choose a practical angle for your research. The first requirement for practicing to be a consultant during Ph.D. work is a practical assignment that allows you to work with a company, preferably with higher or middle management. This means that you have to look for a Ph.D. assignment that involves an organization with a real issue they have not been able to address properly until now. If you can really work with the company in a case based setting or action research setting, this is of course great, but it is also very nice if you have a less direct involvement with the organization, but the case study offers you the possibility to present your practical results and solutions a number of times.

Build an (international) network. A lot of the consultancy where simulation is applied has quite an international character. A good (international) network is an important asset for your career. Networking capabilities, being able to quickly understand the issues of a customer, and being able to present solutions in a clear manner are all important skills to develop. When you want to pursue a career as a researcher, analyst, or entrepreneur, it is still possible to focus on technical issues and work with others who do the project acquisition and client interaction. As a consultant, you do carry the responsibility for the direct interaction with the client, and therefore, you have to develop your networking skills. The relationship with a client is not easy, so you have to be aware of the issues in a supplier – client setting.

Focus on problem solving and communication. As a consultant, you try to help a client deal with a complex issue that is hard to solve within the company itself. In order to convince an organization that a method or solution works look at the business case for the solution. This usually implies that you have to apply a multidisciplinary approach, where you take the business context, economic implications, stakeholder preferences, political and power issues, and social and ethical consequences of the advice stemming from your research into account. These are all important points that management looks for as well when you present your scientific or technical solution. Taking a number of classes on business, policy, and management to learn how to create a good business case can really help you to transfer your ideas to your client. For the organization the problem is only solved when all the issues in addition to the scientific or technical solution have been addressed as well. Again, you can practice some of these skills in a relatively protected environment during your Ph.D. research, with relatively mild consequences if you are not able to address all dimensions of the problem, as your thesis will focus on the scientific angle.

Include publications in trade journals. Probably the best publication strategy to prepare for consultancy is a mixed one. On the one hand, show your absolute best in the top journals, placing you ahead of the competition. On the other hand, prove in your publications that you can apply your theories, methods and tools to deal with real issues in real organizations.

Present your research as often as possible. The development of presentation skills for a convincing translation of your research results into a practical advice is an asset for a consultant. When you are able to carry out practical case studies in organizations, use every opportunity to present your work. Take courses on how to present your work better. Learn to summarize and how to present the key points of your findings in an 'elevator pitch' – a really short summary of the main findings and recommendations from your research. What you exactly address in such a short presentation is very dependent on your audience. For an academic audience, the emphasis is different than for a manager from a client organization. For the client, the business aspects that were mentioned in the 'problem solving' category above, are usually more important to include than just the content of the advice itself.

2.5   Non-academic researcher

Several Ph.D. students continue their career at a governmental or independent research organization, or at a research department of a large company. For a company researcher, the job usually demands are that you are an excellent academic researcher with good analytical skills, who understands what the business needs. This implies that you have to combine the required properties of a number of job types. The same holds for an independent research organization, where there is quite some emphasis on acquisition of new projects. This means that you have to combine some entrepreneurial capabilities with solid academic skills. In all cases, a good track record for your publications is a huge asset.

2.6   No clear career plans or project mismatch

Not every student will know exactly what job type they would prefer after finishing the Ph.D.. Mixed strategies are of course also possible. A solid advice is to never give in on the scientific quality of your research, no matter what type of job you might go for in the end. Section 5 below addresses this aspect in more detail.

Of course it rarely happens that the Ph.D. assignment matches your requirements to prepare for your next job 100%. There are cases where this is more serious than others. When you consider pursuing an academic career, and the Ph.D. assignment does not offer you enough opportunities to make a research breakthrough and to publish in top journals, you might be working on the wrong project. By the way, projects often have quite some flexibility, and researchers are supposed to be headstrong, so with a little bit of effort, the project can be made to include the required properties. The earlier in your research you realize this, the easier it is to adapt the research project (or to switch to another project if that is possible).

Networking and being active in your community should always be possible, independent of the type of project you work on. In modern times, even a limited travel budget does not have to prevent you from networking. Mailing, Skyping, social software with discussion lists, and the use of social networks for professionals such as LinkedIn and Plaxo enable good discussions and co-operation in a network without spending too much on travel. Still, face-to-face meetings are necessary, so it is best to spend them well. If you go to a conference, see who will be there and who you want to meet and about what. If presenting a paper, you can announce the presentation to a number of (international) colleagues you would like to have present in the room. Maybe even send them a PDF of the paper, or an e-mail with the abstract. If they show up, you have the right people in the room to start the discussion you want.

Most of the other points mentioned can be done by any Ph.D. researcher in any country. It is a matter of taking ownership of your Ph.D. project and reserving enough time for a number of activities that will have most of their value after being awarded the doctorate. The question is, is that bad? As long as it does not lead to delays in the Ph.D. project or to loss of quality, the university will also benefit from alumni who are able to quickly find their next job, and to find the type of job they truly want.

3   M&S CORE VERSUS APPLICATION TRADE-OFF

One of the toughest trade-offs to manage in simulation research is whether the emphasis of your thesis is on the theoretical contribution or on the contribution in the application domain. The tracks in the Winter Simulation Conference also reflect this dichotomy; on the one hand there are large domain independent tracks like 'Analysis Methodology' and 'Modeling Methodology', on the other hand we see a large set of a bit smaller application tracks such as 'Health Care', 'Homeland Security', 'Military', 'Business Process Modeling', 'Education', 'Logistics, Transportation and Distribution', etc. If you carefully look at the papers in the tracks, you roughly see a difference in the emphasis of the papers in the two types of tracks. The methodology papers discuss a contribution to the simulation field, and might illustrate it with an example from a certain domain. Usually, the results hold for other domains as well, or they are even fully domain independent. The application papers discuss an issue in the application field for which a (novel) simulation technique has been created and tested. Often, the simulation contribution and the domain are much more tightly interlinked, an results are not automatically valid outside the domain (or even the case) for which they have been developed. It is important to avoid not being good enough in either of the two areas.

Your choice can be related to the job type you are after. To take two extremes; if you want to become a researcher in the simulation field, your theoretical contribution will be most valued. If you want to start working as a consultant or practitioner in an application domain, your empirical results and the contribution to the domain on which you apply simulation will be most highly valued. But these are extremes. Of course more 'middle course' combinations are possible as well. If you are not sure where your emphasis is, you should find out quickly, because it will heavily influence your type and set-up of papers and the choice of journals and conferences. An easy way is to look at the proposed title of your research or the proposed title of your dissertation. If no application domain is present in your main title, your focus is on the modeling and simulation field. If one application domain or even a company name is present in your subtitle, you probably test your method in one or more case studies. The question is then how far you plan to generalize your research results. If the application domain and the contribution you make to that application domain are clearly visible in your main title, your focus is on the domain. Hopefully, you say something about modeling and simulation in your subtitle, otherwise you have to question whether you even do a M&S dissertation.

The networks you are active in, the professional societies to become a member of, the journals you read, the people you talk to, will all be influenced by this choice. When you are not sure where your emphasis lies, try to decide this quickly, together with your supervisor(s).

4   PUBLICATION STRATEGY

No matter what type of job you pursue after your Ph.D., your publications are one of your key assets. Make sure that you develop a publication plan for your research along with developing your research plan. If possible, develop a publication strategy that fits your career plans in terms of type of journals and quality of the journals. Make sure that from each research stage (chapter) you can at least get one conference paper that can be expanded into a journal paper. The conference papers are good for networking, the journal paper are good for your long term visibility. Every Ph.D. research project should potentially lead

to a number of good publications. When you have the idea that is not possible to publish a good n umber of papers from your thesis, either lower your ambition level for the paper to be published, or increase the ambition level for your Ph.D. thesis.

Choosing the right conference or journal for your paper is extremely crucial, but not easy. The main thing to decide first is what the main message of your paper is. Don't make the message too broad, because a very broad paper hardly ever fits the interests of a particular journal or conference. Your paper title is your one-line message of the paper, your abstract is your one paragraph summary of the message. The contents of your paper, and therefore your title and abstract, have to match with the journal publication guidelines or the conference topics. Therefore it is not possible to first write a paper and 'then see where it can be published', as some Ph.D. students state. Either aim for a journal and adapt your paper, or select the journal and adapt the paper outline in an iterative process. For a conference, it is often a bit easier; you want to go to a certain conference for its community, and you adapt your paper accordingly. In order to truly match the interests of a journal, you have to understand what type of papers the journal tends to publish. Therefore, scan the past ten volumes of the journal for papers that are close to your area of interest. If there are none, you might be aiming for the wrong journal. If there are, look at the structure of the papers, and see if you would be able to write your paper in the same style. Do they usually start with a case? Is there always a section with an empirical evaluation in the paper? How formal are the papers? How much literature do they usually cite? Where is the review of literature and earlier work usually discussed? Is there a standard structure for the papers? What is the average length? How much math, figures, tables are usually used? Etcetera. When you can adapt to the usual style of the journal, make sure you also align to the community of the journal. Each journal has a community of editors, regular contributors, and readers. It is usually valued when you link to their set of interests and earlier work. The papers you gathered by studying the past ten volumes might now be useful; by explicitly referencing these papers and linking your contribution to earlier contributions in the same journal, you establish the link with the community. Of course, there should be plenty of references outside the journal you are publishing in, but too many authors forget to embed the paper in the journal community, which decreases the appropriateness of the paper for the journal and thereby lowers the chance of acceptance. What you will see is that there is quite a difference between journals that address generic topics (mathematics, modeling, simulation theory), and journals that aim at application domains. The method and theories to refer to are different. Both types of journals, however, can aim at more theoretical work or more at empirical results. So don't make the mistake to assume that all modeling & simulation journals only value theoretical papers, and journals in application domains of M&S only publish empirical results or case studies.

Papers about pure engineering work, like the development of tools or software, are sometimes hard to fit in a journal, and sometimes even hard to get published at a conference. A paper with "look at what I built" as its main message is not so interesting for the audience. You have to think about the innovation that is contained in the engineered artifact, or in the process of creating that artifact. Make this innovation the main message of the paper, and illustrate it with a working tool. In one of the later sections of the paper. When you have evaluated the method or tool with its intended audience, this is even better, and it can follow the tool display section.

5   RESEARCH QUALITY

Good research is all about quality, the quality of your research process as well as the quality of your results. The quality of the process of conducting your research is dependent on a solid philosophy of science foundation, a good methodological basis, an interesting research question that is answered with an appropriate testing strategy, and a straightforward and focused plan for achieving your results. The quality of your results is, among others, dependent on your theoretical foundation, the alignment with earlier results in the field, the conceptual and theoretical soundness of your research basis, the novelty of the theory, method, or tool that you describe in your thesis, and the quality of the tests that you apply to demonstrate that the research results match the requirements in a sufficient manner.

The outside world will judge most of your achievements on the basis of what you write down about your research in papers and in your Ph.D. thesis. Your next employer will also judge your strengths and weaknesses on the basis of what you wrote. Therefore, make sure you obtain the highest quality possible in everything you write. Have your publications checked by colleagues and if necessary, by a native speaker. Take language courses or scientific writing courses to improve your scientific and professional writing skills. Quality and quantity of your output can be increased if you build your academic and/or professional network early. Through these relationships, you can start to write with others. This has multiple benefits. It builds your network using concrete deliverables, and it makes your network visible to the outside world. Although there is of course some overhead in writing with others, quality usually improves when discussing the contents of a paper with a co-author. Furthermore, if your co-authors have complementary strengths, they can more easily and quickly write the parts of the paper that would otherwise have been harder for you to write. You can therefore focus more on the aspects of the paper close to your research interests. This usually means you can write almost two papers in the time it would otherwise take you to write one. Some Ph.D. students are afraid to share their results and insights with others. Don't. The whole academic world

is built around the quick exchange and sharing of results. Co-authoring papers with others increases the speed of exchange of knowledge, and it also helps to align your research directly with the work of others.

In addition to good publications, your network is one of your most valuable assets. Trough your literature analysis, you can find those people, research groups, and institutes that are close to your research, or that provide supporting theories. Use conferences and workshops to establish contacts. Never forget that after making first contact, you have to actively maintain your network. This will help you when the key players in your field are looking for referees or volunteers. The network can provide you with many benefits during your research: co-authors for papers, reviewers for your work, providers of case studies, and experts for validation activities. If your network is closely aligned with your future job type ambitions, active maintenance during the Ph.D. research is even more important, as your network could provide you with job offers.

When citing, never forget to make a distinction between the original thinkers and their followers. Try to avoid making references to a conference paper of a Ph.D. student who used a certain theory. Rather point to the original author of the theory and thereby give appropriate credit. Also, you will be amazed how often citations are wrong, and how often research results are interpreted out of context or sometimes even quoted totally wrong. By referring to a reference to other work, you run the risk of making wrong assumptions, and you do a disservice to the original authors.

6   FINAL THOUGHTS

Several of the ideas and guidelines in the paper have been developed in the process of doing my own Ph.D. thesis where I violated most of the rules and learned from it. That is a slow process, however, and the world is not always as forgiving as it was in my case. In addition, after coaching two dozen Ph.D. students, and several hundred thesis projects of M.Sc. students, lots of new insights surfaced that I never thought of or cared about when doing my own Ph.D. thesis.

When you want to carry out your Ph.D. work in such a way that it provides added value for your desired career, keep in mind that there are many ways in which you can prepare for a successful career. A Ph.D. thesis provides you with a broad foundation that will prove to be useful in many jobs, even if you are not able to maximize the use of the Ph.D. project for your next job. One word of warning, however. If you plan to pursue an academic career, the ambition level and quality of your research, and a well-chosen publication strategy are of the utmost importance. If you start publishing early and in high-quality journals, you lay a good foundation for your tenure track. Henderson (2008) gives some additional tips for the tenure track, and discusses some recommendations for the tenure track, of which many also hold for the Ph.D. research.

The recommendations contained in this paper have mainly been written from a European (or even Dutch) point of view. There are quite some differences between countries, university cultures, and ways of coaching. The level of freedom you might have in implementing some of the guidelines might differ considerably in your individual case. What is universal, however, is that the Ph.D. title is awarded for demonstrating that you are able to carry out high-quality research in an independent way. The quality of your research, both your process and your results, is the most important asset for your career.

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