

Explaining Women's Careers at a Dutch university: Model building as a method for knowledge elicitation in gender analysis

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Abstract

This paper presents model building as a means to study factors explaining the delay in Women's Careers at a Dutch university. The causal model is based on analysis of 43 interviews, ten focus groups and policy documents collected at the five faculties of a Dutch university. The five researchers involved in this analysis used model building to integrate their knowledge of the research material and reach a shared definition of relevant variables. Model building proves to support the qualitative analysis of gender processes by supporting the identification of main processes and showing the feedback processes at work. The model shows that Women's careers are stimulated by the presence of female academics at higher positions, while masculine norms and the lack of visibility of female academics slow down women's careers. By focusing on the role of image shaping about women's ambitions and performance, it fills in theoretical gaps identified in earlier research about gender processes in organizations.

Key-words: Model building, Gender equity, Qualitative Research, Women's Careers, Human Resource Management, System Dynamics

Introduction

Group Model building is an approved method for supporting managers with strategic decision-making in organizations (Anderson et al, 2007; Richardson and Andersen, 1995; Vennix, 1996). In this article we will evaluate whether model building can also be a useful tool for researchers in

structuring, synthesizing and analyzing complex and multifaceted qualitative data, especially regarding gender processes in organizations. The problem we present in this paper is the under representation of women in the higher positions at a Dutch university. Data were collected with the aim to unravel factors influencing the movement of women in, out and through this particular university's hierarchies. As is the case in most countries around the world, Dutch universities suffer from an under-representation of women in higher positions (Benschop and Brouns 2003; van den Brink et al 2006). This university in particular performed worse than other Dutch universities in the advancement of women (Korsten et al, 2006). The research was initiated by the executive board of the university as it viewed the under representation of women in higher academic positions as a serious problem. The problem needed tailor-made targeting informed by research for the university as a whole and its five constituent faculties (Faculty of Economics, Faculty of Law, Faculty of Social and Behavioral Sciences, Faculty of Humanities and Theological Faculty). Furthermore the executive board wanted to make haste tackling the problem and consequently the timeframe for executing the research was relatively short (October 2007-February 2008), as is often the case with practice oriented research.

To be able to gain an in-depth understanding of gender processes within the different faculties, we used a stepwise qualitative research set-up that was informed by the existing body of knowledge on the position of women in academia. We held 43 semi-structured interviews, followed by series of focus groups (ten focus groups in total). The study produced an enormous amount of qualitative data: 727 pages of interview transcripts, five policy documents and notes of ten focus group meetings. The five researchers, who all performed parts of the data collection and processing of the research material, needed to elucidate their partially implicit knowledge and interpretation of the abundance of data and integrate it into a coherent analysis of the problem. Therefore the model building process under study can be characterized as (1) An effort of a group of researchers which all examined the same problem: the under representation of women in higher academic positions at a Dutch university, (2) an abundance of data of which the knowledge was dispersed among the group members. (3) The necessity of integrating this knowledge into a coherent analysis and (4) a high degree of time pressure.

In this article we first review the existing body of knowledge concerning the position of women in academia. Herewith we show the difficulties of knowledge elicitation regarding gender processes. Secondly, we answer the question how we define model building and where we situate our model building approach in the larger body of literature on System Dynamics. Thirdly we discuss the content of the model we have build, describing coherent parts of the model separately and paying special attention to feedback loops in the system. Finally, we reflect on the theoretical contribution and methodological meaning of our analysis and the role model building played in it.

Women in Academia; The existing body of knowledge

Women's scarcity in the academic top has been examined in different academic disciplines such as psychology, sociology, and recently entered the field of System Dynamics (Campbell and Hovman 2004, Dudley 2007, Bleijenbergh, Benschop and Vennix 2006). In the following we briefly review the most common explanations and the empirical evidence for those explanations. We suggests that dispositional causes (e.g. working time, family responsibilities) may be overestimated, whereas situational causes (e.g. influence of organizational culture, gender stereotypes) may be underestimated in the explanation of career progression of women. Our method of analysis needs to support us in getting insight in the role of culture and gender stereotypes in this particular organization and to show how these factors relate to more situational factors.

The most common explanation for the scarcity of women in higher positions is the pipeline hypothesis. This hypothesis states that it takes a certain period of time, around fifteen to twenty years, before a growing proportion of female graduate's moves up the hierarchy into leadership positions. Research about the Dutch situation shows the pipeline hypothesis doesn't convincingly explain the under representation of women in higher academic positions at Dutch universities. Given the number of female students in the 1980s, a much higher proportion of female managers and leaders would be expected (AWT 2000; Brouns et al. 2004). A System Dynamics model about the American situation leads to a comparable conclusion: the pipeline delay hypothesis is not sufficient to explain the relatively small number of women in American universities (Dudley 2007).

The fact that more women than men work part-time is another situational factor that is often suggested to be an explanation for women's career progression. In the Netherlands, in general, the part-time factor of male and female academics hardly differs (.85 for women, .88 for men). Analyses of the total amount of work hours of male and female academics within this particular university also showed hardly any difference between men and women (1.3 hours) (Van Engen, Bleijenbergh & Paauwe, 2008). A system dynamics model of the American situation suggests the same. Dudley showed that women's part-time employment only explains a small part of the delay (Dudley 2007, 4).

Research is less consistent about the consequences of family responsibilities on career progression in academia. Some studies show that motherhood negatively influences publication productivity (e.g. Portegijs & Brugman, 1998), other research shows that women with children are more successful in their academic careers than women without children (Brouns et al, 2004), whereas yet other studies conclude that motherhood is unrelated to career development (AWT, 2000; Bordons et. al, 2003; Wessseling, 2001). The most likely scenario Dudley finds is that the tag of being a potential 'homemaker' limits women's chances of promotion to higher positions at all levels. Independent of the real behavior of women, employers are reluctant to hire women because they perceive them as people who may quit the workforce to become homemakers. Especially when the fraction of homemakers in the population is high, the likelihood of women moving up the hierarchy is smaller (Dudley 2007, 4).

Herewith the role of gender stereotypes enters the debate. In an American study King (2007) showed that the way supervisors perceive the ambition and performance of female academics is a better prediction of their careers than the real ambitions and performance of women. In her study she shows that supervisors for instance underestimate the number of publications by women and especially by mothers. We would like to further explore this mechanism and wonder if this mechanism is also at work in the Dutch University we examine.

Finally, some studies have considered organizational culture as an explanation for the under representation of women in academia. Some studies suggest women in academia have adjusted to the organizational culture and are just as happy as men (Portegijs & Brugman, 1998). Yet other studies have shown women are less satisfied with their employers, especially with the support of their supervisor (Brouns et al, 2004). We would like to test these opposite claims and would like to examine the role of organizational culture in this particular university in explaining women's career progression.

Summarized, our literature review shows that there are several explanations for the under representation of women in academia. All the explanations may partially contribute to the delay of women's career progress in academia, but further knowledge needs to be developed on the role of organizational culture and gender stereotyping in particular. We especially need to examine how situational causes like stereotypes are related to dispositional causes like working

time and motherhood. We need a method of analysis that helps us to unravel gender stereotypes. Moreover, it should reveal underlying mechanisms that contribute to the reproduction of these stereotypes. In this paper we will evaluate what the contribution of model building is for knowledge elicitation on these issues.

Model building in qualitative research

In this study, we use model building as a method to elucidate and integrate knowledge on the complex issue of gender processes at a Dutch University. We first need to define model building and situate it in the larger body of literature on System Dynamics. We define Model Building as representing a real world system into a System Dynamics model. System Dynamics (SD) is a theory of the structure and behavior of complex systems. The structure has four hierarchical levels: (1) the closed boundary, (2) the feedback loop as the basic system component, (3) levels and rates and (4) goals, observed conditions, discrepancy between goals and observed conditions and desired action” (Forrester 1961, 1987, Vennix 1996, 44-45). The closed boundary does not mean that the system is not influenced by the external environment, but rather separates the dynamically significant inner workings of the system from the rather insignificant influences from the external environment. (Richardson, 1991) SD is used by individual researchers to combine available research material into a causal loop or stock and flow diagram of the researched problem. It might also be used by a group of researchers for the same purpose, as we do in this particular project.

Building SD models with groups of people has become a full sub discipline of System Dynamics under the name of Group Model Building (Andersen et. Al, 2007, Richardson and Andersen 1995, Vennix 1996). The main purpose of this method is however to support strategic decision-making in organizations, rather than to support academic research. Group Model Building refers to a series of meetings where a professional SD facilitator supports a group of managers in building a causal diagram of an organizational problem. Vennix (1999) distinguishes three reasons to involve groups of managers in Group Model Building. One of these is to capture the required knowledge in the mental models of the client group. Building a model together helps to explicate the knowledge of individual participants and enhance team learning. The second reason is to foster consensus on the causes and consequences of an organizational problem. The causal model is a product of common deliberation and so helps to integrate knowledge. The third is to create commitment with a resulting decision. Since the model is the product of a group process, the participants feel connected to the decisions that are enacted from it.

In this research we didn't perform GMB in the strict sense. We rather used the technique of model building with a group of researchers to support qualitative analysis in academic research. The main difference between Group Model Building and model building as applied in our analysis are the problem characteristics. Group Model Building intends to tackle messy problems. Messy problems can be defined (characterized?) as problems in which people hold entirely different views on (a) whether there is a problem, and if they agree there is, and (b) what the problem is (Vennix 1996; 1999). In the research under study the problem at hand was given as the research was initiated by the executive board with the aim of identifying factors influencing the under representation of women in higher academic functions. All researchers agreed with the problem definition. Therefore the problem cannot be defined as messy. Rather, the problem should be defined as causally complex, “not because there are too many variables affecting it, although the number of causal variables is certainly important, but because different causally relevant conditions can combine in a variety of ways to produce a given outcome” (Ragin 1989, 26). Moreover, there was no need to create commitment regarding decisions to be taken from the analysis. The researchers did not have any decision-making power. With their

research report they rather had to deliver input to the executive board of the University, where subsequent decisions would be taken.

Nevertheless, there are also important similarities between our approach and GMB. The model building participants had different knowledge regarding the problem, as they had collected and processed different parts of the huge amount of qualitative material. The model building needed to support the elucidation and integration of this knowledge. Moreover, they needed to reach consensus on how to analyze and interpret the material. Aiming for the most broadly shared interpretation of the empirical material, so called intersubjectivity, is an important quality criterion in qualitative research (Shank, 2006: 84). So, the model building should support the validity of the analysis.

Concluding, the model building process discussed in this paper differs from regular Group Model Building applications. Though a group of researchers was involved in model building, the problem had no messy characteristics. We had to alter the causal complexity of the problem, but did not need to incorporate any strategic complexity. It also differed from individual model building by a single researcher, as applied by Dudley. Although the model is based on analysis of empirical material, the analysis had to be supported by the exchange of knowledge between researchers. Therefore we



Figure 1: Dimensions of Model Building

we situate our model building process in the upper right quadrant of figure 1 and label it collective structuring of complex causal problems using System Dynamics. Individual researchers such as Dudley are in the upper left quadrant, and Group Model Building is in the lower right.

Data gathering

Understanding underlying mechanisms that help or hinder careers in each particular faculty of this university calls for a qualitative research approach. We were interested in the perspective of different actors (decision-makers, men and women in higher positions, as well as at the bottom of the university's career pyramid) within the university on 'what it takes to get promoted' within the universities hierarchies. To be able to collect data from all of these actors in the limited timeframe granted by the university board, we used a stepwise approach. In the first phase of the study we held in-depth interviews with 43 academics (see further). The results of the interviews were discussed in focus groups.

Interviews.

In total we interviewed five deans (all of them male), five chiefs of Human Resources (two males, three females), five female full professors, five female associate professors, ten female assistant professors and five male assistant professors, and ten female academics who left the university during the previous year. The interviews were semi-structured. For each respondent group a different interview protocol was developed (depending on their level of decision-making authority). The existing body of knowledge concerning the position of women in academia was used to develop the interview protocol.

The interviews were transcribed verbatim. After reading a number of interviews the research team developed a coding format. All interviews were coded according to this format by at least one researcher and subsequently all coding formats and interviews were read and complemented

by a second researcher. Two researchers then created a draft analysis of a faculty after which the analysis was discussed and finalized in the research group.

Focusgroups.

The results of the analyses were the input for focus groups with the interviewees to corroborate our findings and deepen our understanding of the problem. This member check of the interview analyses made it possible for us to deepen our analyses and correct problems with interpretation. Next, focus groups were held with all the departmental chairs of each faculty; a total of 35 people, mainly men. First, we collected their personal opinions concerning the causes and consequences of women's under representation in higher academic positions on a brief, open-ended questionnaire at the start of the meeting. We then briefly presented our analysis of the interview data and asked them to reflect on it and come up with possible intervention strategies. The insights of these focus groups further improved our understanding of the processes taking place at the different faculties.

The model building process

After defining the method of model building, we need to specify how we used the method in our research. After the five researchers had been able to process their part of the material, we came together in three meetings that were led by a SD facilitator and supported by a SD modeler. From the start of the model building process there was no doubt on what the central problem was, namely the under-representation of women in higher academic positions at a Dutch university. Soon it became clear that this problem was a stock and flow problem, similar to that defined by Dudley last year (2007). This stock and flow is at the core of the model, and describes the flow of women in, out and through the hierarchy of the university. Its stocks representing the percentage of women in lower and higher academic positions, its flows representing the changes that occur in them as a result of inflow, outflow and promotions. Discussion within the model building sessions focussed on the reasons for stagnation in the flow of women through the university hierarchy. The end result is an explanatory model for this complex causal problem. The model is based on the perceptions of the academics we have interviewed individually and in focus groups. We only included explanatory variables in the model that were mentioned by at least three respondents per faculty, and were found in at least two different faculties. Moreover, we only included relations that were not falsified by statements of other respondents.

There were a number of cognitive and communicative challenges encountered in the model building. First of all, the participants had to elucidate, discuss and verify the variables to be incorporated in the model. Certain issues were dropped from the model because they could not be verified or were falsified by other research material. An associated problem was keeping the model free from explanations we knew from literature study and to incorporate solely those explanations that were actually identified in the empirical material. As discussions became more vivid, there was a real danger that participants' theoretical knowledge on gender issues blended into argumentations. Strict rules on what to incorporate and what not helped to thwart this problem.

The second challenge was the correct conceptualization of variables and their interrelations. Identifying the relevant issues was relatively easy; incorporating these in the model in the right terms was much harder. Discussions on conceptualizations and model structure were quite extensive and sometimes required compromise between participants. The final model was agreed upon by all participants as an accurate representation of the patterns that came up from the empirical material.

A total of four meetings of approximately three hours were devoted to the model building effort. The first meeting was used for the facilitators to get acquainted with the model

building participants, to discuss the research project and establishing a problem variable. Subsequent meetings were devoted entirely to building the model and refining it.

Model contents

The content of the model will be described in the next paragraphs (Appendix 1 shows the entire model). For reasons of intelligibility parts of the model – shown in figures 2 to 7 - will be described separately. Feedback loops have been identified and will be discussed in order to create insight into the fundamental behaviour of the system.

Stock and flow of women’s careers

At the core of the model is a stock and flow diagram. A stock is a unit which in- or decreases during a specific time interval, a flow indicates the quantity with which a stock changes. The values of the stock and flow diagram were not quantified. Rather, it served the visual and explanatory qualities of the model for both the model builders and the intended readers of the rapport.

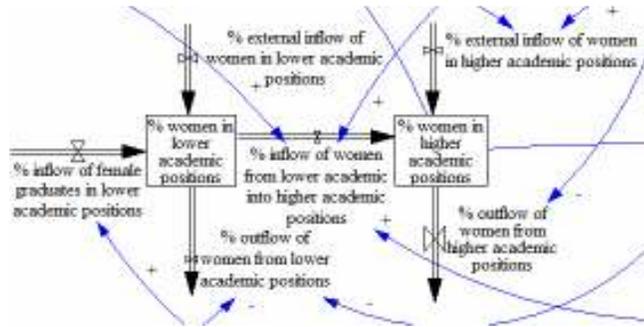


Figure 2: Stock and flow of women’s careers

The stocks indicate the percentage of women currently in higher and lower academic positions, the flows indicate how these values can change over time. As mentioned before, the stock and flow diagram is the core of the model, and there are many variables exerting influence on various flows. The stock variable percentage of woman in higher academic positions influences both masculinity of norms and the percentage of women in networks.

Masculinity of norms

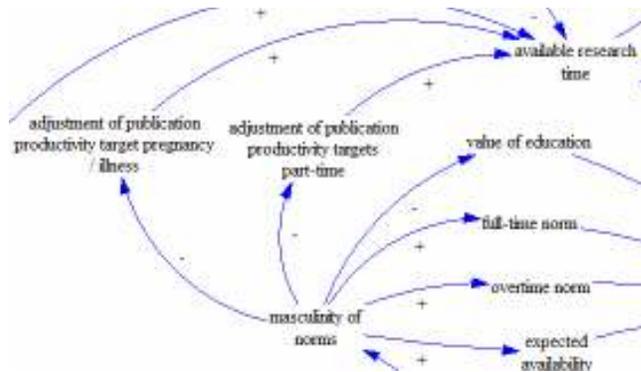


Figure 3: Masculinity of norms

According to the respondents there are certain norms within the university, which are determined by the big proportion of men in higher academic positions. The effect of the masculinity of these norms manifests itself in a number of variables. Firstly in those variables that constitute the normative ideal of the scientist: (a) The degree to which full time work is set as a standard for being an ideal scientist. (b) The degree to which working overtime is seen an inevitable part of being the

ideal scientist. (c) The degree to which it is expected that one is available for work every single day of the week and during the evenings. (d) Status of educational achievements relative to those in research. Respondents attribute these norms to a culture which is dominated by men and argue that women in general do subscribe less to these norms than men do. Non adherence to dominant norms in the faculty environment leads to less congruence with the ideal image of the scientist.

Secondly, masculinity of norms manifests itself in the degree to which management adjusts productivity output targets when illness or pregnancy occurs, or when one works part-

time. According to respondents, the assignment of research time to individual researchers is based on the absolute number of publications rather than the number of publications relative to the time they had actually available for research. This practice bypasses the formal rules for adjustment and negatively affects those academics that work part-time or took sick or pregnancy leaf. Respondents agree this disproportionately affects women. When adjustments would be made on the basis of the relative number of publications, this would make available more research time for women, enabling them to produce more publications.

Perceived congruence of women with ideal image of the scientist

This variable indicates the perceived congruence or discrepancy between perceptions of female academics in general and scientists in general. This congruence is firstly determined by the amount to which respondents think women adhere to the dominant norms mentioned in the previous paragraph. Secondly, a number of measurable efforts such as the number of publications, the amount of international work experience and success in acquiring funding were found to be of importance. Then there are some softer variables, namely the

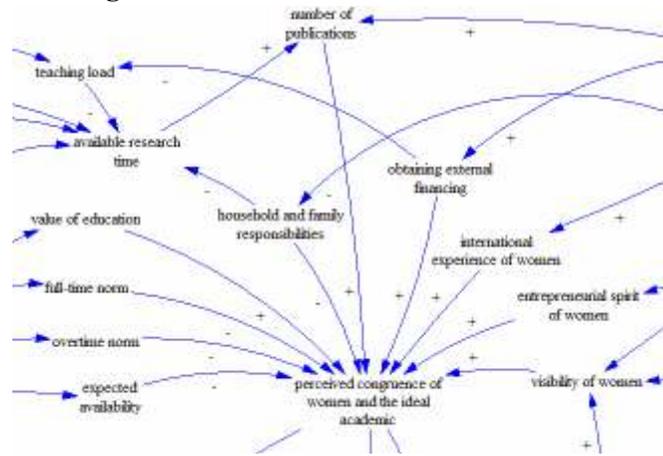


Figure 4: Perceived congruence of women with the ideal image of the scientist

perceived household and family responsibilities of women, their entrepreneurial spirit and visibility that affect women’s congruence with the ideal scientist according to the respondents.

Perceived congruence of women with the ideal image of the scientist has a major influence on the percentage of women in higher academic positions, as it affects both promotions from lower to higher academic positions, and outflow of female academics from both the low and high end of the hierarchy. Respondents agree that managers take their promotion decisions on the basis of the degree to which a candidate fits in their ideal about what constitutes the good scientist. Female academics who have left the university expressed their frustration of not to being seen as serious candidates for promotion. Perceived congruence of women with the ideal scientist is influenced indirectly by most other parts of the modeled system; networks, support (by colleagues, spouse and supervisor), the quality of job assessments and the masculinity of norms.

Networks

This part of the model describes the effect of networks on the percentage of women in higher academic positions. Numerous respondents mentioned an effective network as an important facilitator for graduates to be accepted into lower academic positions and for academics in lower positions to be promoted to higher echelons of the organization. Networks are even more important for entrance into higher academic positions from outside the university. An effective

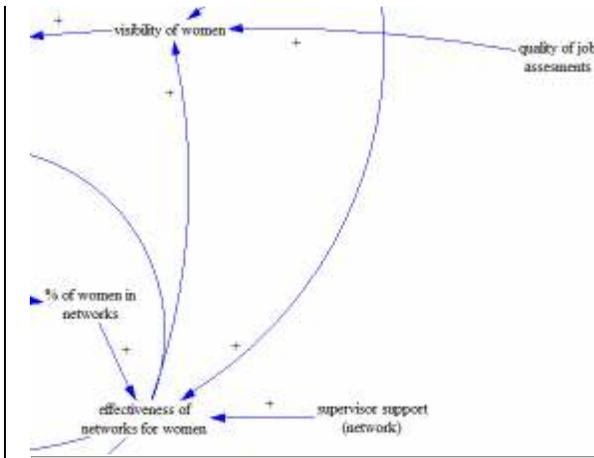


Figure 5: Networks

network improves both the general visibility of women within the university and the academic world, which offers direct opportunities for career improvement. According to respondents, the effectiveness of networks for women increases when there is a greater overall number of women present in relevant networks in the academic environment. The proportion of women present in relevant networks is partly determined by the percentage of women that occupies a higher academic position.

Self-confidence

Self-confidence can be seen as the central variable in this part of the model. Respondents argue that self-confidence of women influences the visibility, effectiveness of networks and the entrepreneurial spirit of women. Self-confidence is enhanced through support of a supervisor, co-workers and spouse, while support of the spouse also increases the chances of women gaining international work experience.

Self-confidence increases the effectiveness of networks, as well as increasing the visibility of female academics in and outside of the organization.

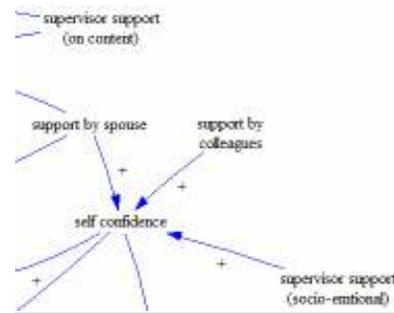


Figure 6: Self-confidence

Budget versus Merit principle

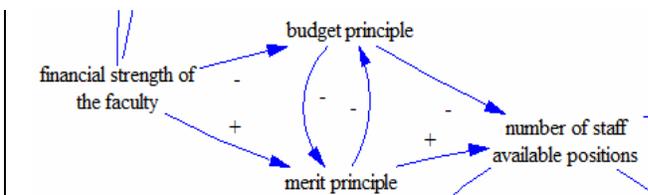


Figure 7: Budget versus Merit principle

This part of the model refers to the principles faculties use in their personnel management. The budget principle dictates that someone who is applicable for a higher function is promoted only when there are sufficient staff positions available within the faculty. The merit principle dictates that whenever someone

meets the requirements for promotion, he or she is promoted immediately. At the university examined in this research, both principles were in use. Which principle dominates depends on the financial resources of the faculty. The principle in use determines the number of free positions, where the merit principle allows for faster career paths than the budget principle.

The number of available staff positions influences the percentage of external inflow of women in higher academic positions and promotions of women from lower into higher academic positions. According to the respondents, when there are fewer positions available, the flow through the hierarchy is slower for all academics. As the percentage of men is bigger in the higher age groups, their (partial) replacement by younger women will take place in a slower time frame. The budget principle effectively slows down the upward mobility of all academics, thereby delaying the process of reaching gender equity. The number of available positions also affects the outflow

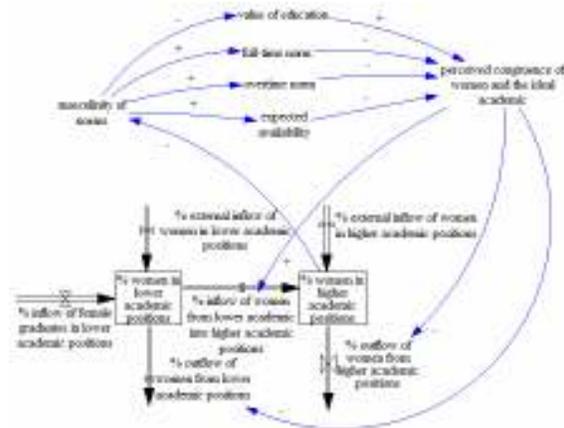
of women from lower academic positions. The frustration of not getting promoted has led to a number of women leaving the university.

Feedback loops

We distinguish a feedback loop when a change in the value of a variable, via two or more successive causal relationships in the system, influences the value of the variable itself. Identifying these feedback loops provides insights on the behavior of the system. There are positive and negative feedback loops. A positive feedback loops shows that changes in a variable strengthen each other. A negative feedback loop shows that changes in one variable are compensated by changes in another variable; a stabilizing process. When the internal structure of the model is correct, the behavior of the feedback loop corresponds with the characteristics of the real world system. We discuss the four main feedback loops we distinguish in the model.

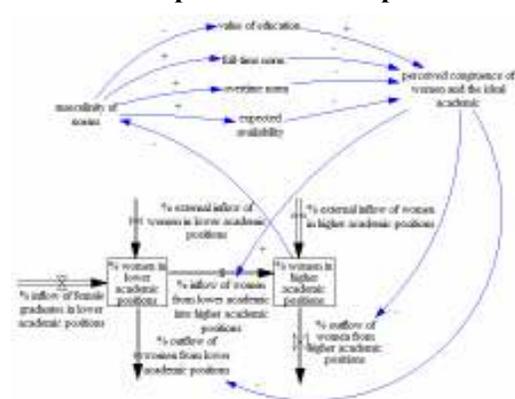
Feedback loop 1: Masculinity of norms:

This main feedback loop runs from the percentage of women in higher academic positions, through masculinity of norms, perceived congruence of women with the ideal scientist back to the percentage of women in higher academic positions. This is a positive feedback loop, meaning that when there is a higher proportion of women in higher academic positions, norms become less masculine, increasing the congruence of women with the ideal scientist, thereby decreasing the percentage of women flowing out of higher and lower academic positions, while increasing the percentage of women being promoted from lower into higher academic positions, thus leading to a higher percentage of women in higher academic positions. An example of this dynamic is found in the Faculty of Law which has a high percentage of women in high positions. In this faculty there are a relatively greater percentage of women flowing into high positions and a relatively smaller percentage of women flowing out of high positions.



Feedback loop 1: Masculinity of norms

Feedback loop 2: Publication productivity targets



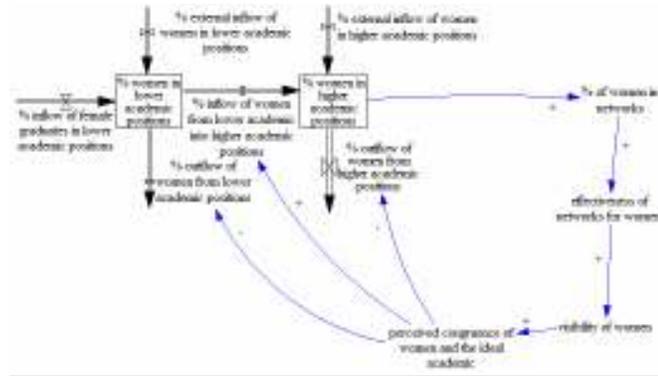
Feedback loop 2: Publication productivity targets

Academics agree that performance in their jobs is mainly measured by the number of publications. As in the previous feedback loop, a higher percentage of women in higher academic positions supports different practices. A higher percentage of women up the hierarchy leads to better execution of adjusting publication productivity targets for part-time work and sick- and pregnancy leaf, thereby increasing the amount of research time available for those that have not been able to work full-time. Via a larger number of publications, these people come closer to the ideal image of the scientist, thereby increasing their career chances. As relatively more women work part-time, the practice of adjusting output targets

is beneficial for women's careers. Again we have a positive feedback loop, as a more female management may decrease the masculinity of norms, thereby supporting the adjustment of publication productivity targets.

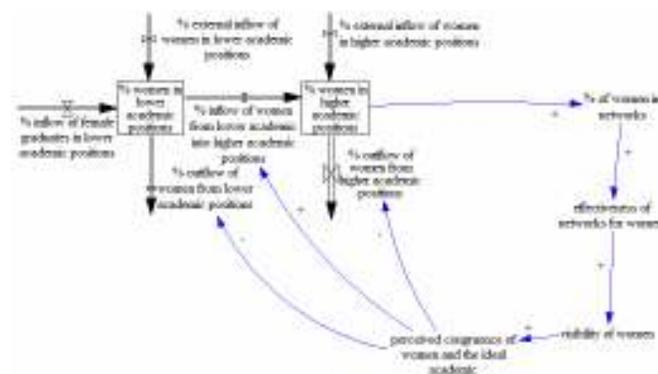
Feedback loop 3: Visibility of women

The percentage of women in higher academic positions influences the percentage of women in relevant academic networks. As the overall proportion of women in networks increases, these networks become more effective for women, thereby increasing their visibility within and outside of the organization, increasing the chances of being promoted and decreasing the chances women will leave the university. Again there is a positive feedback loop, indicating that a growing percentage of women in academic positions has a self enhancing effect.



Feedback loop 3: Visibility of women

Feedback loop 4: Networks and women



Feedback loop 4: Networks and women

This feedback loop shares many similar variables with the previous one, but focus here is on the direct opportunities for career moves offered by networks, instead of the increased visibility that comes with having effective networks. This positive feedback loop shows the relation between the percentage of women in higher academic positions and factors that support gender equity. When women make up a greater percentage of relevant networks, networks become more effective for women, supporting their career paths within the academic world.

Behaviour of the model:

Feedback loops give valuable insights into the behavior of the modeled system. Four major feedback loops were identified which all had positive polarities. Feedback loops with positive polarities describe processes which are self reinforcing. Since men are much better represented in higher academic positions, and thus set the norms and are better represented in relevant networks, we would expect to find a decreasing number of women in higher positions. With that respect the model doesn't fit the real situation at the Dutch university. The amount of women in higher positions is not diminishing, but has been stable for years and is very slowly increasing. This is probably due to the compensating force of the stocks-and-flow in the model; the percentage of women in the younger cohorts has been growing for years. To summarize, the careers of women are delayed by the processes described in the four feedback loops, but this is compensated by the fact that the proportion of women amongst graduates en PHD students grows. Moreover, there have been policies aimed at supporting gender equity. They were aimed

at increasing the effectiveness of networks for women and their self-esteem. Finally, also in the present situation some women do correspond to the image of the ideal scientist. They are perceived to adhere to the dominant norms, for example full time availability.

The model also offers valuable information on the relative importance of different variables. All feedback loops contain the variable percentage of women in higher academic positions, which indicates that this variable is essential for the behavior of the system. The proportion of women in higher positions at the university has a major impact on the chances women have to advance their careers. Recognizing the central role of this variable may offer a starting point for an intervention. A single increase in the proportion of women at higher positions would increase the perceived congruence of women with the ideal scientist and thereby increases their chances of promotion.

Evaluation of Model Building

In this paper we show the results of model building in examining the factors influencing the movement of women in, out and through the university hierarchy. We showed the central role of four feedback loops in explaining the problem, respectively the dominant norms, publication productivity targets, the visibility of women and the networks of women. The research question was: What is the contribution of model building for the qualitative analysis of gender processes at a Dutch university? We answer this question by reflecting on the theoretical contribution and methodological meaning of our analysis.

Theoretical contribution

With regard to the theoretical contribution of our analysis, our results confirm the important role the perceived image of women plays in comparison to their real performance as identified by King (2007). We show four feedback processes that show how this perceived image is build up, namely the dominant masculine norms about what it means to be an academic, publication productivity targets, the visibility of women and the networks of women. The academics that were interviewed agreed that the dominant norms can be characterized as masculine. Thus, the ideal scientist behaves like the traditional male breadwinner, working full-time, prepared to work over-time and is always available. Moreover, the academics perceive female scientists to fit less to this image than their male colleagues. Both male and female academics expect women to prefer part-time work, to be less prepared for overwork and prioritize their family.

Moreover, dominant norms are articulated in terms of productivity output targets. By describing the feedback loop of publication productivity targets, we show that the (lack) of adjustment of productivity output targets to actual working time, offers an explanation for women's career development. Since publication output is measured in absolute figures rather than in relation to invested working time, people who work part-time or took pregnancy leave are put at a disadvantage to their full-time colleagues without career interruption.

Next to the fact that the dominant norms are considered masculine, academics agree that women are less visible in- and outside of the organization. Although some women are perceived to adhere to the dominant norms, their visibility within and outside of the organization is less than the visibility of their male colleagues. Since academics agree that promotion decisions are taken on the basis of the visibility of potential candidates, a lack of visibility proves a disadvantage. Therefore, our qualitative analysis shows that the perceived image of women has to do both with the lens through which people look at them and the spotlight that is directed at them.

Summarized, our model adds to the existing literature an understanding of the particular mechanisms that help to produce gender stereotypes. Model building helped us to distill the shared conceptions of what it means to be an academic at a Dutch University, what norms are dominant and how these norms are reproduced by the lack of women in higher academic positions. It helps to understand that the careers of women are delayed by the processes described in the four feedback loops, but that this is compensated by the fact that the proportion of women amongst graduates en PHD students grows.”

Methodological meaning

What was the methodological meaning of model building to the qualitative analysis of gender processes? The method of model building first of all enabled processing a huge amount of research material into a compact Systems Dynamics model. Although the model contains a total of 37 variables and 61 relations, it remains a very compact summary of all patterns and linkages identified in the huge amount of research material. It helped us to identify the main variables and their interrelations and to see the interconnections between the different processes at work.

Model building enabled discussions and sharing of knowledge across the research team. The researchers participating in the model building sessions had knowledge of the interviews, focus groups and documents of at least two faculties; none of the participants had a complete overview of all the research material. Coding the interview material was divided over five researchers and all analyses were double checked. The interview material, focus group material and policy document material were thus covered by at least two researchers. Model building supported a quick exchange of knowledge and identification of the main processes at work, like for example the relation between the amount of women in higher positions and the visibility of women. The technique also supported interpreting of the research material. There was agreement on the general research issue, but intensive discussions were necessary to bring variables into operation in the model. The presence of a facilitator and modeler forced us to explicate all our assumptions. An example of this was the discussion on the variable ‘perceived congruence of women and the ideal scientist’. By recognizing the fact that model building enabled generalizing the research findings onto a more abstract level, many interesting details had to be omitted, as well as relations between variables that were found in only one faculty. Thanks to the presence of a facilitator these decisions could be made quickly. The decision was made that only relations which were mentioned by three people in at least two faculties, and could not be falsified, would be incorporated in the model. This helped us to focus on the relations on which the most unanimity existed, namely on work and family life, perceived image and networking.

Conclusion

To conclude, what theoretical contribution did model building make to knowledge elicitation in the analysis of gender processes at a Dutch University? And what is the methodological meaning of the instrument for such an analysis?

Firstly, the model shows how different, sometimes opposing explanations of women’s careers progression are interrelated and influence each other. The amount of women in higher positions at the Dutch University is not declining, but has been stable for years and is very slowly increasing. While the increase of female graduates would support an increase in women at higher academic positions (towards a situation of gender equity?) within fifteen or twenty years, the present low amount of women in these positions slows down this development. The model shows how this influences dominant norms, productivity output targets, the visibility of women and the networks of women.

In practical sense, the process of model building helped the research team to identify intervention strategies. It helped us to identify the essential role of the actual representation of women in higher positions. Once the amount of women in higher positions increases

substantially, this effects the image of the ideal scientist, the amount of women in networks etc. Since the research team only had an advisory role to the executive board, we formulated a series of advices linked to the causal model.

The methodological meaning of model building in a qualitative research on this scale, is that it helped to structure discussions on the interpretation and analysis of the material. Modeling helped us to elicit the knowledge individual researchers had derived from the qualitative material and share it within the group. The presence of a facilitator helped us to focus on the main processes at work and to validate each different relation with all the researchers in the team.

Limitations and opportunities

A limitation refers to the explanatory force of the model. The relations and variables identified are entirely based on the experiences of academics within the university. The model represents their beliefs about organizational reality, rather than the reality as it could be objectively observed. An example is that all of our respondents pointed at part-time work as one of the most decisive factors in the delay of women's careers in academia. However, quantitative analyses of the actual working hours of this university's academic personnel revealed that women on average only work 1,3 hours less than men. Another example was that all respondents believed that parenting would have a negative impact on productivity output. Quantitative analysis showed that for both men and women, having children was positively related to the number of publications. The causal loop diagram is a representation of the shared construction of reality of the 80 academics working at the same Dutch University as reconstructed within the research team. This doesn't differ from the results of Group Model Building to support strategic decision-making amongst managers. The model that results is a social construction. The constitution of its variables is bases upon the shared beliefs and opinions of the academics which were interviewed. Constitution is used here as the collective definition of what something is, that is the intersubjective agreement upon the rules that lay down 'what counts as' (Schwaninger 2006, 525). So the model may become less relevant when these constitutions change (van der Smagt 2006). This means that our explanation is bound to time and context, its universal applicability has to be further tested.

The theoretical limitations don't hinder the practical applicability of the model for policy making. The executive board of the university was looking for a tailor-made analysis of the actual situation at the five faculties and the university as a whole. The causal model that supported our analysis was considered as a tool to enable a quick overview of the results of the research. The fact that the research involved interviews with all the deans and focus groups with all the heads of departments, gave the conclusions strong legitimacy towards the executive board. The causal model that summarized the general opinion on the causes and consequences of the problem was easily accepted as a description of the real situation. To the surprise of the research team, the executive board took over all recommendations put forth in the final report. The university policy is based on what people consider as real and so the common construction of gender processes is also real in its consequences.

References

Adviesraad voor het Wetenschaps- en Technologiebeleid (AWT). 2000. *Halfslachtige wetenschap: Onderbenutting van vrouwelijk potentieel als existentieel probleem voor academia*. AWT-advies nr. 43.

Andersen, David, Jac Vennix, George Richardson and Etienne Rouwette, 2007. *Group model building: problem structuring, policy simulation and decision support*. [Http://www.albany.edu/~gpr/JORS06.pdf](http://www.albany.edu/~gpr/JORS06.pdf).

Benschop, Yvonne, and Margo Brouns. 2003. *Crumbling Ivory towers: Academic Organizing and its gender effects*. *Gender Work and Organization*, 10 (2) : 194-212.

Bleijenbergh, Inge, Yvonne Benschop and Jac Vennix. 2006. *Group Model Building as a gender Mainstreaming Instrument*. Paper presented at the Conference "Equal is not enough" September 13-15, 2006, Antwerp University, Belgium

Bordons, Maria, Morillo, Fernanda. Fernandez, Teresa. & Gomes, Isabel. 2003. One step further in the production of bibliometric indicators at the micro level: Differences by gender and professional category of scientists. *Scientometrics*, 57 (2): 159-173.

Brouns, Margo, Rie Bosman, and Ilse van Lamoen. 2004. *Een kwestie van kwaliteit: loopbanen van cum laude gepromoveerde vrouwen en mannen*. Groningen, Rijksuniversiteit Groningen.

Campbell, Debra and P. Hovman. 2004. *Is Your Organization Collegiality-Challenged? A Case Study Demonstrating the Effect of Unconscious Gender Bias*. 22nd International Conference of the System Dynamics Society. The System Dynamics Society: Oxford, England.

Dudley, Richard. 2007. *The Equity Supply Chain: Is it the Cause of So Few Women in Management and Leadership Positions?* 25th International Conference of the System Dynamics Society. The System Dynamics Society: Boston, MA, USA. <http://systemdynamics.org/conferences/2007/proceed/papers/DUDLE171.pdf>.

Forrester, Jay. 1961. *Industrial Dynamics*. MIT Press: Cambridge, MA.

Forrester, Jay. 1987. Lessons from System Dynamics modelling. *System Dynamics review* 3(2): 136-149

King, Eden. 2007. *The effect of bias on the advancement of working mothers: Disentangling legitimate concerns from inaccurate stereotypes as predictors of career success*. Dissertation. Houston, USA: Rice University.

Korsten, M., Visser, A., Willemsen, T., & van Zwol, W. (2006). *Monitor vrouwelijk hoogleraren 2006*. Stichting de Beauvoir & Universiteit Leiden, EQUALproject Participatie als Prioriteit/ Universiteit Maastricht, Landelijk Netwerk Vrouwelijke Hoogleraren en Vereniging van Nederlandse Universiteiten.

Portegeijs, Wil & Brugman, Marga. 1998. *Eerdaags evenredig? Belemmeringen en beleid ten aanzien van de doorstroom van vrouwen naar hogere wetenschappelijke functies*. Leiden. Rijksuniversiteit Leiden.

Ragin, Charles. 1989. *The comparative method; moving beyond qualitative and quantitative strategies*. University of California press, Los Angeles.

Richardson, George, and David Andersen. 1995. Teamwork in group model building. *System Dynamics review* 11(2): 113-137.

Richardson, George. 1991. *Feedback Thought in Social Sciences en Systems Theory*. Philadelphia. University of Pennsylvania Press.

Schwaninger, Markus. 2006. Comment on the paper by van der Smagt. *Systems Research and Behavioral Science* 23: 525-527.

Shank, Gary (2006) *Qualitative Research: a personal skills Approach*. New Yersey: Pearson Prentice Hall

Van den Brink, Marieke, Margo Brouns, and Sietske Waslander. 2006. Does Excellence have a gender? A national research study on recruitment and selection procedures for professorial appointments in the Netherlands. *Employee Relations*. 28 (6) 523-539.

Van Engen, Marloes, Bleijenbergh, Inge & Paauwe, Jaap. 2008. *Vrouwen in hogere wetenschappelijke functies aan de Universiteit van Tilburg; Processen van instroom, doorstroom en uitstroom nader bekeken*, Tilburg: Universiteit van Tilburg
<http://www.uvt.nl/medewerkers/vrouwen.html>

Van der Smagt, Ton. 2006. Causation and Constitution in System Dynamics: Modelling a Socially Constituted World. *Systems Research and Behavioral Science* 23: 513-524

Vennix, Jac. 1996. *Group model building – Facilitating team learning using System Dynamics*. John Wiley & Sons Ltd, Chichester.

Vennix, Jac. 1999. Group model-building: Tackling messy problems. *System Dynamics review*. 15(4): 379-401.

Appendix 1: The total model

