

# Micro-Simulation Studies of the Status of Women and Minorities in Government Organizations

Garnett Picot and Ted Wannell

*Statistics Canada*

## **Introduction**

The level of representation of women and “visible” minorities, those whose skin colour allow them to be readily identified, in the Canadian federal government has been an issue for some time. In 1990 a major task force, “Beneath the Veneer”, concluded that women were concentrated in lower paying occupations with little opportunity for advancement. More recently, a similar task force, “Embracing Change”, concluded that visible minorities are under-represented at almost all levels. The task force proposed that one-fifth of all people recruited to the federal government, and one-fifth of people promoted to the executive level, should be visible minorities, a group that now accounts for 8% of federal employment. The idea is to dramatically increase the employment flows for minorities (hiring, promotions) so that their representation in government will rise quickly. Even more recently, the human rights commission conducted an audit of employment shares for women and visible minorities, and established targets. These recommendations and targets raise questions regarding the speed at which the representation rates for women and visible minorities can in fact change. Typically, very large changes in employment flows (recruitment, promotions, exits) are required to make relatively small changes in the composition of total employment.

Reports that seek to improve the participation of under-represented groups tend to focus on recommendations that will influence the levels of recruitment, promotions or exits for these groups. Assessing the progress in overall representation rates that might reasonably be expected from changes in these employee flows requires simulations of future employment levels and distributions. It is necessary to ask “what if” questions, such as “If recruitment shares for women are increased to 50%, what effect will that have on female representation rates at the junior, intermediate and senior job levels over the next ten years?” Most organizations do not have the tools available to ask such questions. Implementing a useful simulation model can assist in evaluating and developing strategies to improve the representation of women and visible minorities.

## **The Simulation Model**

The simulation model discussed here, referred to as PERSIM, was developed in Statistics Canada to address a wide range of human resource issues, such as:

- possible future shortages of senior managers due to rising retirements, and the initiatives that might be implemented to prevent such shortages
- employment equity issues, such as the effects on future visible minority and female representation rates of altering recruitment and promotion patterns,
- whether particular downsizing targets can be met without resorting to layoffs,
- establishing entry recruitment levels that will provide the required supply of people at intermediate and senior job levels in the future
- whether the people rising to senior levels in the future will have the experience necessary, given that promotion rates are likely to increase dramatically, and tenure at each job level to fall.

Effective decision making in all of these areas requires some understanding of expected future employment trends under various scenarios. The model produces simulations of the future levels and distribution of employment (across a wide range of dimensions), based on assumptions regarding recruitment levels, and promotion, retirement and quit probabilities. These probabilities are a function of a number of variables such as age, job level, years in the job, and personal characteristics. It is a *micro*-simulation model, meaning that the input to the model consists of data on every employee (i.e. *micro*-records) in the organization. For each year of the simulation, the status of each employee is determined based on the estimated probability of each event. Hence, in each year of, say, a ten year simulation, every employee is either promoted (or not), quits, retires, or stays at their current job, level and organizational unit. Micro-simulation models have numerous advantages over aggregate projection models. Even conceptually simple models, such as the one described here, can address some complex issues. For example, there is concern that as retirements and promotion rates rise, the people filling the senior management jobs will not have acquired the experience necessary to

---

succeed in them. A simulation can produce data on expected average tenure (i.e. experience) over the coming decade in jobs that “feed” the senior management group. This would provide some evidence on the “experience” issue.

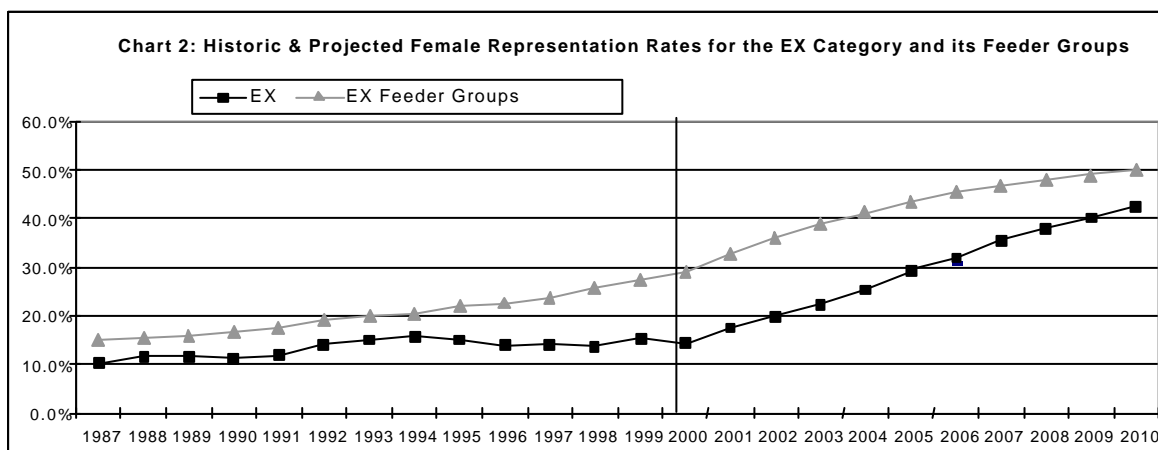
### Simulations of Female Participation in the Executive Group

The simulation model has been used to analyse women’s position in a number of different occupations, but one of the most prominent is that of that of senior management (executive or EX). Based on the level of women in the occupational groups that feed the senior management jobs, a representation target was established by the human rights commission at just over 30%. That is, one would expect 30% of senior executives in Statistics Canada to be women.. A simulation can help demonstrate the implications of such a goal. The important factors in a simulation designed for this purpose are: the share of women among entrants to the organization, particularly those on track to be executives, the total number of entrants, the promotion rates of men and women, and their retirement and quit rates. A normal modelling approach is to start by using the actual probabilities (of hiring, promotion, retirements, etc.) of some recent time period in the simulation, and assume that they will persist over simulated period (in our case to 2010). That is, one asks “if the future resembles the recent past regarding the probabilities of employee movement, what will be the outcome?” In the scenario to simulate future employment shares for women, the retirement probabilities, probabilities of quits, and hires from outside (which are almost non-existent at this level) were all set at the levels observed over the past three years. The promotion rate was adjusted. Over the past three years, the promotion rates into both the executive (EX) group, and the groups that feed the EX group, here referred to as EX-1 (EX minus 1 level), EX-2 and EX-3 levels, have been much higher for women than men (table 2). But these promotion rates will have to rise significantly in the future to prevent the number of senior managers from declining due to a rapid rise in retirements. Other simulations indicate that the EX and the EX feeder group will lose between 40% to 75% of current incumbents to retirement over the next decade. This is an issue for which the simulation model has been used extensively in another context.

**Table 2: Promotion Rate of EX Group**

	Past 3 Years		Simulation	
	M	F	M	F
EX-1 to EX1	1.7%	4.4%	10.9%	10.9%
EX-2 to EX-1	3.9%	7.1%	6.6%	6.6%
EX-3 to EX-2	5.2%	7.6%	5.2%	5.2%

For the purposes of the simulation discussed here, it means that there is an opportunity to rapidly increase the female participation in the EX group, since the large outflows are much more male dominated than the expected inflows. If one assumes that the promotion rates will be identical for men and women in the future, they would have to rise to the levels indicated in table 2 to keep the total number of EXs from declining. For example, the promotion rate into the EX group from the EX-1 level is assumed to rise from between 1.7% and 4.4% currently, to almost 11% in the simulation. Such an increase raises issues regarding the availability of adequately trained and experienced individuals to fill these jobs. The simulation model has been used to address this issue as well. Historically, very few people were hired from outside the organization to fill EX jobs, and hence this was not altered in the simulation. This practice may change, and simulations could be done to test the effect of this.



In the simulation produced here, the female representation rate reaches 30.9% (the target) by 2006, and continues to rise to over 40% by 2010 (chart 2). The female share of executive feeder group employment rises to 50% by 2010. There is an opportunity to increase the representativeness of women in the executive groups very quickly over the coming decade.

### Simulations of Visible Minority Participation in the Executive Group

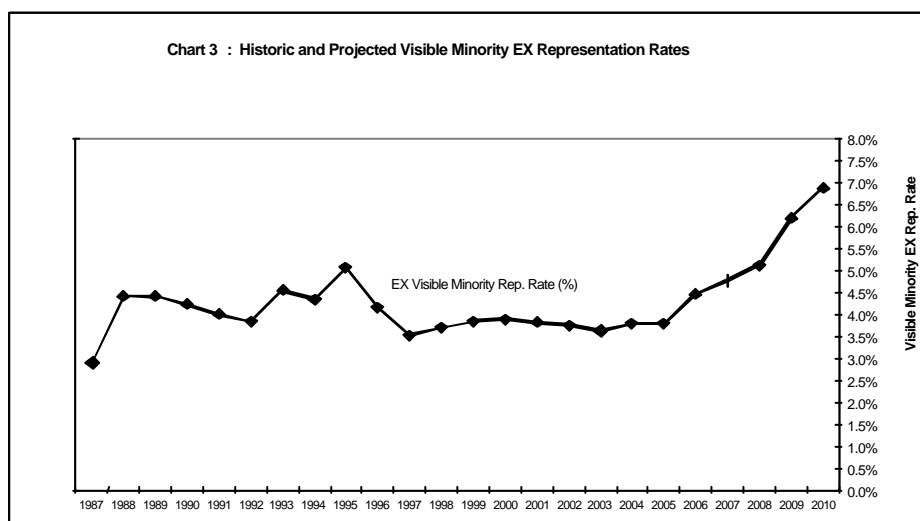
Both the past trends and future dynamics as they affect participation are very different for visible minorities than they are for women. Visible minority representation rates in the executive group, at around 4.5%, have changed little during the past decade. This is in part because general hiring and promotion rates in Statistics Canada were low during the past decade (associate with government restraint) while the representation rate of visible minorities was increasing in the general population in Canada. Changes in the external labour market were not passed on to the executive group inside the organization. Furthermore, the simulation model suggests that many of the visible minority incumbents in the executive group and its main feeders will retire in the next few years. Unlike the case for women, retirements will work against increasing the representation rate, at least in the short term.

What does a simulation suggest may happen under various assumptions? As before, retirement and exit probabilities were set at historical levels. The promotion rates into the executive and EX feeder groups was higher during the recent past for visible minorities than for non-visible minorities. As with the simulation for women, it is necessary to increase promotion rates to keep the number of EXs from declining. Following the recommendations in a recent task force report, and the recent historical pattern, promotion rates for visible minorities are set at 30% above those for others (table 3).

**Table 3: Visible Minority /Non-Minority Promotion Rate in Simulation - EX group**

	Visible Minorities	Non-Visible Minorities
EX minus 1 to EX1	10.4%	8.0%
EX minus 2 to EX minus 1	8.6%	6.6%
EX minus 3 to EX minus 2	8.2%	6.3%

However, as shown in chart 3, these measures do not change the representativeness of visible minorities over the next three years, largely because of an expected large number of visible minority retirements. After that time, however, the representation rate climbs steadily under these assumptions, reaching almost 7% by 2010.



With the slightly higher promotion rates for visible minorities (assuming positive effects of human resource and awareness programs), the representation rate would fall just under the set goal of 7.4%, which is based on the labour market availability. Other simulations could be run to determine the effect of, say, reducing the exit rate of visible minorities, or introducing a new recruitment program to try to hire visible minorities at the executive and executive feeder group levels. Historically few people were hired from external sources at the senior levels, but such a program would reduce the upward pressure on the promotion rates, something that

may be desirable. Extensions of this simulation analysis could inform management of the number of visible minorities that would have to be hired at the executive level to reduce the simulated promotion rates into the EX and its feeder groups by, say, 50%, bringing them closer to the historical values. Simulations such as this would help determine if such a recruitment program is realistic.

### **Successfully Implementing the Model**

The PERSIM simulation model is now being used extensively in Statistics Canada and a number of other federal government departments. The successful implementation of this model rests on a few key points:

- There must be important human resource issues that require the kind of input that the model can provide. This model was developed in response to a particular set of HR issues. It was not developed independently, and issues sought out for its application.
- The model should be conceptually simple. Individuals are hired, promoted, retire, etc. with some probability. The effect on future outcomes, in terms of employment levels and distributions, of altering the probabilities can be easily understood by users, who frequently have little quantitative training. The probabilities can be altered within a reasonable range as dictated by historical values, future plans, or particular targets, providing credibility to simulations.
- The most important implementation concerns do not relate to technical issues, but to the interaction with the users. The simulation staff must be capable of using the model in a decision-making environment, and explaining the model output in a useful manner. This means being familiar with the HR issues, converting these issues, often in an innovative way, into specific questions that the model is capable of addressing, and then explaining the results and their implications in a straightforward manner to management.
- There must be a process whereby management questions and issues are brought to the attention of staff who can frame them in terms that will allow the model to produce useful results, and that will allow the results to be fed back in a useful form to management. In Statistics Canada, management committees on human resource issues provide the mechanism that allows this to occur.
- Management must be convinced that the model can assist them with their decision-making, and support the initiative. Without such support, the use of the model, and its direct influence on decision making, will diminish over time.

### **Conclusion**

Human resource planning is becoming increasingly important in the Canadian federal government. The expected rise in retirements is raising issues about the possible lack of trained people to replace them, particularly among the executive and professional ranks. After years of cutbacks and little hiring, government is attempting to recruit a large number of talented employees, particularly at the entry level. As demand for employees at intermediate and senior levels increases, promotion rates are rising, and will likely continue to do so. Following more than a decade of a relatively little employee movement, the situation has become very dynamic. The opportunity to achieve real gains in terms of the representation and status of women and visible minorities, particularly at the senior levels, is much greater in this dynamic environment. Without employee movement, gains are difficult. With high levels of retirement, promotions and recruitment, gains are easier to realize. Recent task force reports have set goals and objectives for different ministries and occupational groups.

But assessing to what extent hoped for gains and targets are realistic requires some form of simulation modelling. Changes in recruitment goals and practices interact with retirement patterns, which in turn effect promotion requirements. The PERSIM model, first developed by Statistics Canada ten years ago, is now imbedded in the human resources decision making process of the organization. This quantitative approach to supporting HR decision making has spread to other large government ministries. Following a decade of relative stagnation, the Canadian government is faced with a very dynamic human resources field over the next decade, and simulation studies will help plot the course to achieve desired goals.

---