Occupational Labour Demand and Supply in Canada

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*The views expressed in this document are the author’s and do not necessarily reflect the opinions of Human Resources and Skills Development Canada or the Federal Government
Presentation Outline

I. Introduction to the Canadian Occupational Projection System

II. Data and Classification Systems

III. Projection Methods, Innovations and Challenges

IV. Summary and Direction of Future Work
A Brief History of COPS

- 1982 (Apr.) - The Canadian Occupational Projection System (COPS) was created
  - replaced the Canadian Occupational Forecasting System (COFOR)
- 1983-1988 (The developmental years)
  - Model development and enhancement
  - Forging partnerships
  - Projection production
- 1989-1993 (Sector studies era)
- Increased emphasis on sector studies
  - Relevant to program activities (immigration and training)
- 1994-2004 (LMI Emphasis)
  - Greater focus on Labour Market Information
    - Production of Job Futures
Recent Developments (2005-2011)

- Projection results used in support of policy and program analysis
- Production of labour supply, demand and imbalances at the broad skill and occupational level
- Ongoing model enhancement and development
- Provide outputs for use in Labour Market Information (LMI)
  - Occupational Summaries
  - Projection Data
- Provide outputs for use in fast tracking immigration claims
  - Contribute to the list of high demand occupations
- Disseminate to the public
  - Detailed data
  - Broad analysis
Goal of the COPS System

The Goal of the system is to *estimate ex-ante labour market imbalances at the occupational level* in support of policy analysis and labour market information production.
Classification Systems

- **National Occupational Classification (NOC)**
  - Classifies occupations into skill levels (education usually required for entry) and skill types

- **North American Industrial Classification System (NAICS)**
  - Standardized industrial classification
  - Aggregated into 33 COPS Industries

- **Classification of Instructional Programs (CIP)**
  - Encompasses the field of study choices of students
  - Aggregated into approximately 50 COPS major fields of study (MFS) by level of education
# National Occupational Classification Matrix (NOC)

## National Occupational Classification Matrix 2006

The National Occupational Classification (NOC) matrix provides an overview of the classification of the workforce. It offers an insight into the NOC to see its alignment on the basis of skill levels and to observe how the NOC is monitored across the range of the matrix. The four skill levels are categorized as follows:

- **Skill Level A**: Occupational usually requires university education.
- **Skill Level B**: Occupational usually requires college education or apprenticeship training.
- **Skill Level C**: Occupational usually requires secondary education or on-the-job training.
- **Skill Level D**: On-the-job training is usually provided for these occupations.

### 1. Professional, Scientific, and Technical Occupations

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>011</td>
<td>Administrators - Management Level</td>
</tr>
<tr>
<td>012</td>
<td>Administrators - Executive Level</td>
</tr>
<tr>
<td>013</td>
<td>Administrators - Professional Level</td>
</tr>
<tr>
<td>014</td>
<td>Administrators - Government Level</td>
</tr>
<tr>
<td>015</td>
<td>Administrators - Other Level</td>
</tr>
</tbody>
</table>

### 2. Management Occupations

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>021</td>
<td>Marketing and Sales Occupations</td>
</tr>
<tr>
<td>022</td>
<td>Human Resources Occupations</td>
</tr>
<tr>
<td>023</td>
<td>Finance and Administration Occupations</td>
</tr>
<tr>
<td>024</td>
<td>Business Occupations</td>
</tr>
</tbody>
</table>

### 3. Health Occupations

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>031</td>
<td>Physicians and Surgeons</td>
</tr>
<tr>
<td>032</td>
<td>Dentists</td>
</tr>
<tr>
<td>033</td>
<td>Nurses and Midwives</td>
</tr>
<tr>
<td>034</td>
<td>Medical Technologists and Technicians</td>
</tr>
</tbody>
</table>

### 4. Occupations in Social Assistance, Rehabilitation, and Legal Services

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>041</td>
<td>Social Workers</td>
</tr>
<tr>
<td>042</td>
<td>Physiotherapists</td>
</tr>
<tr>
<td>043</td>
<td>Occupational Therapists</td>
</tr>
<tr>
<td>044</td>
<td>Psychologists</td>
</tr>
</tbody>
</table>

### 5. Occupations in Education and Training Services

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>051</td>
<td>Teachers and Other Instructional Occupations</td>
</tr>
<tr>
<td>052</td>
<td>Educational Administrators</td>
</tr>
<tr>
<td>053</td>
<td>Educational Support Occupations</td>
</tr>
</tbody>
</table>

### 6. Sales and Service Occupations

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>061</td>
<td>Sales Occupations</td>
</tr>
<tr>
<td>062</td>
<td>Service Occupations</td>
</tr>
</tbody>
</table>

### 7. Occupations in Transportation and Utilities

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>071</td>
<td>Transportation Occupations</td>
</tr>
<tr>
<td>072</td>
<td>Utilities Occupations</td>
</tr>
</tbody>
</table>

### 8. Occupations in Arts, Culture, Recreation, and Entertainment

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>081</td>
<td>Artists and Designers</td>
</tr>
<tr>
<td>082</td>
<td>Actors and Performers</td>
</tr>
</tbody>
</table>

### 9. Occupations in Community and Social Services, Support Occupations, and Other Services

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>091</td>
<td>Community and Social Services Occupations</td>
</tr>
<tr>
<td>092</td>
<td>Support Occupations</td>
</tr>
<tr>
<td>093</td>
<td>Other Services Occupations</td>
</tr>
</tbody>
</table>

### Notes

- The NOC matrix is updated regularly to reflect changes in the occupational landscape.
- The matrix can be used for manpower planning, workforce development, and occupational migration analysis.
- The NOC matrix is a tool for employers to understand the skills and qualifications required for various occupations.
Main data sources used in the projections

<table>
<thead>
<tr>
<th>Data Sources</th>
<th>Principal Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Statistics Canada)</td>
<td></td>
</tr>
<tr>
<td>Labour Force Survey (Monthly)</td>
<td>- Primary data to project employment growth by occupation (expansion demand)</td>
</tr>
<tr>
<td></td>
<td>- Occupational distribution of non-PSE graduates (high school and less than</td>
</tr>
<tr>
<td></td>
<td>high school) and discontinuants (from PSE)</td>
</tr>
<tr>
<td>Census (Every 5 years)</td>
<td>- Provide the labour force participation rate of immigrants</td>
</tr>
<tr>
<td></td>
<td>- Allocation of new immigrants by occupation</td>
</tr>
<tr>
<td>National Graduates Survey (Every 5</td>
<td>- Primary source of data on how graduates by field of study map into</td>
</tr>
<tr>
<td>years)</td>
<td>employment in specific occupations</td>
</tr>
<tr>
<td>Post-secondary Student Information</td>
<td>- PSIS data used to project new school enrolments and the new supply entering</td>
</tr>
<tr>
<td>System (Annual)</td>
<td>the labour market from the different education levels</td>
</tr>
<tr>
<td>Annual Demographic Statistics</td>
<td>- Demographic projections used for immigration, emigration, deaths as well</td>
</tr>
<tr>
<td></td>
<td>as inputs for other “supply-side” models</td>
</tr>
</tbody>
</table>
Summary of COPS Projection Methods

Demographic and Macroeconomic-Industrial Projections

Employment

Replacement Demand:
- Retirements
- Emigrants
- Deaths

Labour Force

Labour Demand

Job Seekers:
- School leavers
- Immigrants
- Net reentrants

Net Mobility

Labour Supply

Future Labour Market Imbalances by Broad Skill Level
Change in employment versus change in labour force by broad skill level

Future Labour Market Imbalances by Occupation
Labour demand versus labour supply by occupation
Imbalances at the broad skill level

- The analysis of **broad skill imbalances** compares growth in employment by skill level to growth in the labour force by educational qualification.
- The 45° line represents balanced growth between job openings and job seekers at the broad skill level.
- The starting points of the analysis are important, particularly during volatile periods.
- The analysis is used primarily to make overall assessments before presenting detailed occupational evaluations.
Expansion Demand

- Projects the new occupational demand stemming from anticipated economic growth
- Projections of occupational shares (140 occupations) are made within each industry group (33 industries)
- Autonomous equations for occupational clusters
  - Allows related occupations at the detailed level to trend together
- The results are decomposed into occupational and industrial effects using shift-share analysis as an analytical and validation tool

![Graph showing occupational and industrial effects](image-url)
Replacement Demand: Retirements

- Projects new job openings generated by existing workers leaving their current positions because of retirement
  - Retirement is defined as a permanent withdrawal from paid employment for those aged 50+
- Aggregate retirement rates by age and gender are computed using tax filer data (due to lack of reliable alternative data sources)
- Occupational Retirements are computed by ageing the occupational profiles of employment (Age Distribution Model)
- Total Occupational Retirements are constrained to equal aggregate retirements
School Leavers

- The school leavers model accounts for new entrants into the labour market from the education system.
- Student flows are estimated by OLS regression.
- Estimated student flows are converted to field of study choices by a fixed share vector.
- 2 field-of-study to occupation transition matrices are used:
  - The first scenario constrains leavers into “intended occupations” by assuming certain fields and levels of study do not intend to work in specific occupations (i.e. bachelor in anthropology is not compatible with food counter attendant).
  - The second matches graduate outcomes to the occupational classification of recent labour force entrants by age and education.
  - Comparison between these facilitates an analysis of intended versus realized outcomes (contributes to analysis of occupational mismatch).

Source: COPS 2011 Reference Scenario.
Demographic-Driven Components

- Many model components rely on simple extrapolations and rely primarily on demographic factors:
  - The *Immigration Model* (labour supply flow) relies on a fixed participation rate and occupational vector combined with a gross population inflow generated by the demographic model
    - Work is currently underway to include dynamics in the occupational transition vector
  - *Emigration* (Replacement Demand – labour demand flow) is simply computed using the demographic accounts combined with occupational and participation rate assumptions
  - *In-service mortality* (Replacement Demand – labour demand flow) uses age-specific death rates combined with occupational age distributions

- In addition, synthetic cohort approaches are used to obtain *net labour market re-entrants, net occupational mobility* and the *unemployment add-factor*
Imbalances at the Occupational Level

The analysis of occupational imbalances compares the number of job seekers to the number of new job openings as a share of base year employment.

- The 45° line represents balanced growth between job openings and job seekers at the broad skill level.
- The starting point of the analysis matter, particularly during volatile periods.
- The analysis is used primarily to make overall assessments before presenting detailed occupational evaluations.
Stock-Flow Consistency

- All Occupational projection models, with the exception of the expansion demand and labour force participation model, are estimated as flows.
- There is no single anchor to the aggregate labour market situation.
- All results are reconciled to the aggregates via a stock-flow accounting system:
  - both historical estimates and projections.
Labour market conditions

- Components are combined to produce a qualitative assessment of conditions in occupation by component
- Qualitative assessments of employment prospects are compiled
Technical challenges

- Occupational mobility is fairly rudimentary in the system
- Many flows are only captured as residual series in the stock-flow reconciliation
- Many of the data series used are constructed internally
  - often very limited snapshots of data are used to construct entire time series
  - this is difficult to validate
- Evaluating the accuracy of all system components is problematic given time constraints
  - This is particularly problematic as policy analysts want to know the degree of certainty associated with each projection
Conceptual challenges

- Ex-ante imbalances require a constant wage to generate excess demand or supply – our demand side is determined within equilibrium framework
  - We have no feedback between demand and supply via wages or employment adjustment
  - The current supply side is treated as an assessment of whether educational and immigration trends are capable of meeting the anticipated (market-determined) growth in demand

- Are the model results appropriate for Policy Analysis or LMI?
  - Do point estimates produce too much false certainty?

- In the school leavers model, the evaluations of anticipated outcomes often rely on analyst judgement
  - It is uncertain whether it is reasonable to construct an “ex-ante” educational to occupation transition matrix based on assumptions
Future Work

- Results of the 2011 projection cycle will be posted on the internet
- Continuing model improvement work
- Work on expanding the accounting system for the stock models
  - Major revision of the labour force participation model
- Research and modelling of occupational mobility flows
- Next projection cycle is in 2013
Thank You

For Canadian occupational projection data, occupational summaries and technical documentation please visit:

www23.hrsdc.gc.ca