# A thematic approach to regional economic development: Technical report for the state of Maine development strategy 2020-2029

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# A Thematic Approach to Regional Economic Development-

# Technical Report for the State of Maine Development Strategy 2020-2029

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**Abstract:**

This paper proposes a new approach to regional economic development that attempts to bring together sector and place-based strategies through the use of thematics. By connecting new measures and existing diagnostics we demonstrate how a region may identify emerging industrial themes based on their existing sectors, their labor pool, and their innovative capacity. By connecting often disparate heritage industries to new niche growing areas, a region might adapt to global and regional trends. To demonstrate this new approach, it is applied to data for the US state of Maine*.

**Keywords:**

Regional Economic Development; Place-based Policies; Thematics; Industrial Analysis

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## Introduction

All economies have spatial pockets of growth, areas that drive a country forward and generate new capital and output. Equally, there are areas that struggle to grow economically and are challenged by physical endowments and social dynamics. Regional economic development policies have sought to better address these challenges, particularly in peripheral regions, by focusing limited resources on a set of priorities. Traditionally these activities have targeted either industrial development (prioritizing sectors) or place-based approaches, (prioritizing endogenous human capital and the promotion of innovation). Both have merits and have been widely analyzed within academic literature as well as in practical policy settings. However, to date neither approach has a clear or objective way of being adopted in practice and there remains significant criticism surrounding implementation and performance.

## Background to the Approach

The approach outlined here does not intend to replace any existing sectoral or growth strategies but intends to enhance and compliment them by linking together existing competencies. It suggests that to leverage and enhance the existing industrial strengths a more integrated approach to development must be adopted. Picking individual sectors or clusters creates a path dependency, with industries focusing on what has worked rather than what might work next. Current industries with high employment growth or a strong competitive advantages could be better seen as the primary building blocks for the next wave of economic development. A new broader approach to development seeks to conjoin elements from across industries under common core themes. This "*thematic approach*" could be seen as combining the strengths of the existing value chain with nascent or emerging potential within the nexus points between industries. For example, in the last couple of years the forest product industry in Maine has seen quantum leaps forward in development where new products have begun to emerge, such as nanocellulose. This product takes advantage of the great abundance of trees with cutting edge science and engineering from a budding life sciences industry. To keep pushing this evolution, support is needed in the existing value chain, i.e. loggers are still required to fell trees and transport is still required to mills, in addition to new elements such as coders, chemists and biologists. This thematic approach requires cross cutting labor force policies that generate the depth of skills and training needed from basic to advanced degrees.

## Methodology

To identify the themes, we conducted an in-depth investigation of the changing sectoral make-up of Maine. This work uses a combination of existing metrics (discussed below, for a summary see Table 2) which seeks to answer three questions:

1. What are the core industries of employment in Maine?
2. Which specific industries have the potential to generate greater output and value-added for Maine?
3. Based on the specific industries identified in (1) and (2), what are the common themes that connect them?

To meet the first objective, we identified the relative strengths of the Maine economy using a benchmark of the U.S as a comparative. The primary measure in understanding the relative strength of Maine's base economy is the location quotient (LQ), calculated for both employment and establishments.

This was done first in a highly aggregated way at the 2-digit NAICS code level, followed by the same calculation at the 3, 4, 5 and 6 digit levels. This is a unique approach within industrial analysis, which often focuses only on detailed sectors at the expense of understanding the large key drivers behind a region's employment.

By combining both in this analysis, we have the ability to form a more layered view of the economy and have the best chance of identifying how the base industries are evolving. Objective (2) wished to drill down which specific industries were key to increasing output and value-added. The results of the first analysis were stratified to form 2 groups: those that make up the base sectors and those which have the strongest growth potential. New metrics were then calculated to determine which of these "potential" industries also had strong growth in value-added and output. Additionally, new measures of relative growth based on industrial size were also calculated using the Birch Index.

From the empirics calculated for objective (1) and (2) a qualitative inductive analysis was carried out to establish any common themes that connected the key industries. The idea is to move beyond simple NAICS codes and look more holistically with the notion of competitiveness, clear asset configuration, and markets. This process led to the identification of industrial themes based on core assets or competencies the state has. Themes are collections of industries that have some common core purpose. That purpose might be defined by similar or new emerging markets, technology, location-specific assets, knowledge, or skill base. These themes span the value chain and contain industries spanning from extraction to final products. The inclusive nature of the thematic based approach means we do not lose potential breakthrough industries that may never be identified at early stages from simple employment or output growth based on a single NAICS code.

This work identified 4 core themes: **Food, Forest Products**, **Technical services** and **Making and Manufacturing.** An important and novel aspect of this approach is to allow overlap between the industries in each of these themes. An industry could appear under multiple themes; for example, *seafood product preparation and packaging* has ties to Food, Forest Products, and Making & Manufacturing. Thus, innovations in this singular area could have significant rebound effects across the economy. By supporting these themes, there is a greater capacity for the development of new products at the nexus points, where local and global trends push diverse industries to work together such that new products or even new industries emerge. Figure 1 shows how the base industries connect to the themes and to the nexus points. Figure 2 depicts how trends drive these nexus points to produce new products or services.

Finally, objective (3) sets out to establish what the necessary pool of labor required is to support the growth of these themes. Again the nature of the thematic approach means this labor pool cuts across multiple sectors, thus providing a more *robust, resilient workforce.* Given the nature of the

plan is about the future, it was thought wise to use projected sector occupation requirements over the next five years. Using proprietary industry data obtained from EMSI[1], industry-level occupation growth measures including relative size in terms of numbers employed as well as median annual wages were calculated. This data allowed us to form a list of occupations needed to support the themes (Table 3).

These occupations are identified using detailed SOC codes. However, in practice, these detailed distinctions between occupations are not always meaningful, given that skills are often transferable and can support the production of different products. Therefore, we have included occupations more generally. For example, "Machine Operators" in lieu of the more detailed "Packaging and Filling Machine Operators." It must be noted that this is not an exhaustive list as the dynamic nature of the thematic approach means occupational strategies must change as the economy does. Nevertheless, it provides a good first step, and we later suggest in the *Metrics to support the development of the Themes* section on how this must be continuously updated.

## Metrics

This section detailed the formalization of all the methods used within the formal identification of the themes. The Location Quotient (LQ) remains a powerful spatial economic tool to understand the relative strength of a sector (Miller et al. 1991, Crawley et al. 2013, Boix et al. 2016, Crawley and Munday 2017, Issenhour et al. 2018, Crawley and Hallowell 2020). To identify the sectors, a comparative analysis of the regional and national levels of employment figures for individual industries is adopted. The simple employment location quotient is constructed by equation (1).

$$LQ_{ir} = \left(\frac{E_{ir}}{E_r}\right) / \left(\frac{E_{in}}{E_n}\right) \quad (1)$$

The LQ for a particular industry (i) within a given region (r) has two parts. The numerator is equal to the employment within the industry ($E_{ir}$) divided by the aggregate employment of the region ($E_r$). This ratio is then divided by its national equivalent, that is the national level of employment in the industry $E_{in}$ divided by the aggregate employment of the country $E_n$. Employment is not the only data that can be used in LQ's; other studies such as Guimaraes et al. (2008) have used both establishment level and employment data. Theoretically, the quotient may be calculated using either of these values, as was done by De Propris (2005) to establish the relative dominance of a particular characteristic. Therefore, a new formulation of the LQ can be constructed:

$$LQF_{ir} = \left(\frac{F_{ir}}{F_r}\right) / \left(\frac{F_{in}}{F_n}\right) \quad (2)$$

[1] https://www.economicmodeling.com/tag/occupation-data/

Within this formulation F is the number of establishments in the ith sector. The interpretation of the LQ remains the same in both formulations—if the calculated value is greater than one, the region has a greater share of establishments in that industry. The work of Miller et al. (1991) describes the quotient as fielding a coefficient of how represented an industry or characteristic is within a region. To assess whether the industries in Maine are indeed the highest growth industries irrelevant of their size, a modified version of the Birch Index (BI) (Birch 1979) is utilized. To reduce the impact of firm size on identification of a high-growth firms, Birch constructs an indicator that combines both the relative and absolute growth in one metric. This effectively measures the difference between the employment in the period t and the employment over a three-year period, reported as an index.

For the purposes of this work we construct the index at an industry level rather than for the firm[2]equation (4).

$$GrowthRt = \frac{(E_{t+3})-(E_t)}{E_t} * 100 \qquad (3)$$

$$BI = (E_3 - E_0)\frac{E_3}{E_0} \qquad (4)$$

By supplementing the regular growth rate with the BI, we can take account of both relative and absolute growth of employees during the period. The final analytical component used to determine Maine's relative strengths is the consideration of value added[3]. Using proprietary data from EMSI, we identify 6-digit NAICS sectors which have a GRP/worker which is larger than the average across all industries. This adapts the standard growth equation (3).

**Metrics to support the development of the Themes**

Using a thematic approach requires continuous monitoring. This is not a static process, and as such, there needs to be continued new analysis of the current metrics along with the development of new indicators. Three new measures should be adopted to support the continued growth of the themes:

- Labor matching efficiency Index
- Skill demand matrix
- Nascent growth industries index

Labor pooling is an essential component of the theme-based approach, therefore there needs to be a greater level of knowledge both about where labor market tightness is occurring as well as where efficiency is greatest.

[2] Using a combination of 4-digit, 5-digit and 6-digit NAICS codes

[3] In this work, value added is defined as GDP per worker.

To this end, a new measure, the Labor matching efficiency index using quarterly data, will be constructed and estimated using the approach in Crawley and Welch (2020). This technique focuses on how the level of unemployment affects the number of new hires. In more efficient labor markets, this process happens more quickly. The labor market efficiency index must be complemented with a measure of skill demand, which assists in understanding industries' requisites for growth. A new quarterly dashboard of skill requirements could utilize information about job vacancies to keep track of how these are changing across time. These trends could help support the wider training and education landscape in the state. The other important dimension of the theme-based approach is discovering new industries that emerge over time. This is a complex task but essential to foster growth and economic output. Using a series of proxy data combining patents, research grants (applied and granted) along with venture capital, a new picture of nascent and emerging industries will be developed. Across time, trends within this data could help policymakers in Maine to support growing niche sectors.

## Caveats

We emphasize that while this thematic approach is ultimately data-driven and relies on empirical evidence, it also relies on qualitative induction based on the judgment of the researcher. For example, a key sector may have an LQ less than one but is growing and has high value-added; in this case, the researcher may include it despite not meeting every criterion mentioned above. Perhaps its LQ is high, but it employs few and has relatively low value-added. In this case the researcher might decide to exclude the sector. This demonstrates how the analysis of themes requires care and thoughtfulness on the part of the analyst. The final product of themes, labor pools, and trends are finalized using the researcher's judgment. However, at their core, these decisions must be justified by the existing data.

Similarly, emerging trends and products or services found at nexus points are often inherently unmeasurable or difficult to identify with existing available data. For example, there currently does not exist a NAICS code for nanocellulose production. The purpose of a more thematic approach is to be broad, leaving room for future developments in global markets and technology that are difficult to predict. For this reason, the identification of emerging trends must come from a more inductive approach. These sources might include information from recent academic conferences, successful academic research grants, reports from industry focus groups, or even anecdotal evidence pointing to new innovative developments.

For example, the recent unveiling of the largest 3D printer in the world at the University of Maine Advanced Manufacturing and Composites Center included several components of existing industries, together culminating into a manufacturing activity yet to be defined by traditional sector codes[4]. The record-breaking 25-foot 3D printed boat is an example that combines boat building, [Boat Building NAICS 336612], and wood cellulose production [Miscellaneous Wood Product Manufacturing 321999] - a product innovation that gives new life and longevity to two legacy industries through the introduction of innovative technology. To highlight the difficulty in using traditional industry data to predict these emerging trends and product developments, consider that there is no existing code for 3D printing firms.

[4] https://www.mainepublic.org/post/video-umaine-unveils-worlds-largest-3d-printer-and-patrol-boat-it-printed

Many that are currently operating in the US are classified under 323111 - Commercial Printing (except Screen and Books), a sector that also captures firms that print products like calendars, stationery, and magazines. NAICS data is a crucial tool in understanding the base industrial capabilities of the region; however, many emerging trends will likely fall through the cracks if the researcher does not supplement these data with other sources. This point is central to the concept of a thematic strategy. Simply selecting priority sectors is not always sufficiently flexible to allow these types of new innovations. Combining existing capabilities with emerging industries and developing and supporting the existing labor pool will allow Maine to remain agile in the face of global trends and thus foster innovations.

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## Appendix

### Table 1. Description of Variables Used

| Variable | Description | Source | Time |
|---|---|---|---|
| Employment | Annual averages of number employed by disaggregated (2-6 digit) NAICS sectors, state-level, private firms | Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) | 2014-2018 |
| Employment projection | Forecasted growth of number of jobs by 6-digit NAICS sector | Economic Modeling Specialists Intl (EMSI) | 2008-2023 |
| Establishments | Annual averages of number of establishments by disaggregated (2-6 digit) NAICS sectors, state-level, private firms | BLS QCEW | 2014-2018 |
| Annual Growth Rate - Employment and Establishments | Historical over -the-year growth rate of employment, establishments by disaggregated (2-6 digit) NAICS sectors, state-level, private firms | BLS QCEW | 2014-2018 |
| Location Quotients (LQ) - Employment and Establishments | Annual averages of LQ by disaggregated (2-6 digit) NAICS sectors, state-level, private firms | BLS QCEW | 2014-2018 |
| Occupations, total all sectors | Number in occupation by detailed SOC (occupation) code, Maine, all occupations | BLS Occupational Employment Statistics | 2018 |
| Occupations, by sector group (theme) | Number in occupation within 6-digit NAICS sectors in Maine, % of industry total employment in occupation | Economic Modeling Specialists Intl (EMSI) | 2018 |
| Wages by occupation, total all sectors | Median annual wage by detailed SOC (occupation) code, Maine, all occupations | BLS OES | 2018 |
| Wages by occupation, by detailed sectors | Median annual wage by detailed SOC code within detailed 6-digit NAICS sectors in Maine | Economic Modeling Specialists Intl (EMSI) | 2018 |
| Occupation growth forecast | Forecasted growth of detailed occupations within 6-digit NAICS sectors, state level | Economic Modeling Specialists Intl (EMSI) | 2018-2023 |
| Gross Regional Product (GRP) per worker | GRP per worker, inflation-adjusted, by 6-digit NAICS sector | Economic Modeling Specialists Intl (EMSI) | 2008-2018 |

**Table 2. Variables and Metrics used to Support Objectives**

| Objective: Identify Base Industries | |
|---|---|
| **Metric** | **Variables** |
| Location Quotient | Employment |
| | Establishments |
| | |
| **Objective: Identify Key Industries** | |
| **Metric** | **Variables** |
| Location Quotient | Employment |
| Birch Index | Establishments |
| Growth rates | Value Added |
| | Output |
| | |
| **Objective: Identify necessary labor pool** | |
| **Metric** | **Variables** |
| % of total industry | Occupations |
| Projected growth | Wages |
| Median annual wage | |

**Table 3. Projected Key Occupations and Labor Pool Needs**

| Projected Key Occupations 2023 |
|---|
| Machine & equip. operators |
| Supervisors & operations managers |
| Scientists |
| Lab technicians |
| Software Developers |
| IT professionals |
| Engineers |
| Data Analysts |
| Carpenters |
| Biologist and Biophysicists |

## Table 4. Key Sectors within Themes

| Food |
|---|
| 31181 Bread and Bakery Product Manufacturing |
| 111334 Berry (except Strawberry) Farming |
| 311520 Ice Cream and Frozen Dessert manufacturing |
| 3114 Fruit & Vegetable Preserving and Specialty Food Manufacturing |
| 111211 Potato Farming |
| 311710 Seafood Product Preparation and Packaging |
| 11411 Fishing |
| 111419 Other Food Crops Grown Under Cover |
| 11251 Aquaculture |
| 311213 Malt Manufacturing |
| 311813 Frozen Cakes, Pies, and Other Pastries Manufacturing |
| 312120 Breweries |
| 312140 Distilleries |
| 424460 Fish and Seafood Merchant Wholesalers |
| 722511 Full-Service Restaurants |
| **Forest Products** |
| 321911 Wood Window and Door Manufacturing |
| 3322121 Paper (except Newsprint) Mills |
| 321920 Wood Container and Pallet Manufacturing |
| 333243 Sawmill, Woodworking, and Paper Machinery Manufacturing |
| 113310 Logging |
| 337122 Nonupholstered Wood Household Furniture Manufacturing |
| 311710 Seafood Product Preparation and Manufacturing |
| 32111 Sawmills and Wood Preservation |
| 321992 Prefabricated Wood Building Manufacturing |
| 337212 Custom Architectural Woodwork and Millwork Manufacturing |
| **Making and Manufacturing** |
| 312120 Breweries |
| 316210 Footwear Manufacturing |
| 32541 Pharmaceutical and medicine manufacturing |
| 32615 Urethane and Other Foam Product (Except Polystyrene) Manufacturing |
| 33231 Plate Work and Fabricated Structural Product manufacturing |
| 33392 Material Handling Equipment Manufacturing |
| 33661 Ship and boat building |
| 311213 Malt Manufacturing |
| 3114 Fruit and Vegetable Preserving and Specialty Food Manufacturing |
| 311520 Ice Cream and Frozen Dessert Manufacturing |
| 311710 Seafood Product Preparation and Packaging |
| 339113 Surgical Appliance and supplies manufacturing |
| 336412 Aircraft Engine and Engine Parts Manufacturing |
| **Tech Services** |
| 115310 Support Activities for Forestry |
| 484220 Specialized Freight (except Used Goods) trucking, Local |
| 522320 Financial Transactions Processing, Reserve and Clearinghouse Activities |
| 541370 Surveying and Mapping (except Geophysical) services |
| 541380 Testing Laboratories |
| 541512 Computer Systems Design Services |
| 54171 Research and Development in the Physical, Engineering and Life Sciences |
| 541720 Research and Development in the Social Sciences and Humanities |
| 56142 Telephone Call Centers |
| 31181 Bread and Bakery Product Manufacturing |
| 311920 Coffee and Tea Manufacturing |
| 312112 Bottled Water Manufacturing |
| 312140 Distilleries |
| 32111 Sawmills and Wood Preservation |
| 32121 Veneer, Plywood, and Engineered Wood Product Manufacturing |
| 321992 Prefabricated Wood Building Manufacturing |
| 321999 All Other Miscellaneous Wood Product Manufacturing |
| 322110 Pulp Mills |
| 322121 Paper (except Newsprint) Mills |
| 325620 Toilet Preparation Manufacturing |
| 33221 Cutlery and Handtool Manufacturing |
| 337212 Custom Architectural Woodwork and Millwork Manufacturing |

**Figure 1. Process flow for the Thematic Approach**

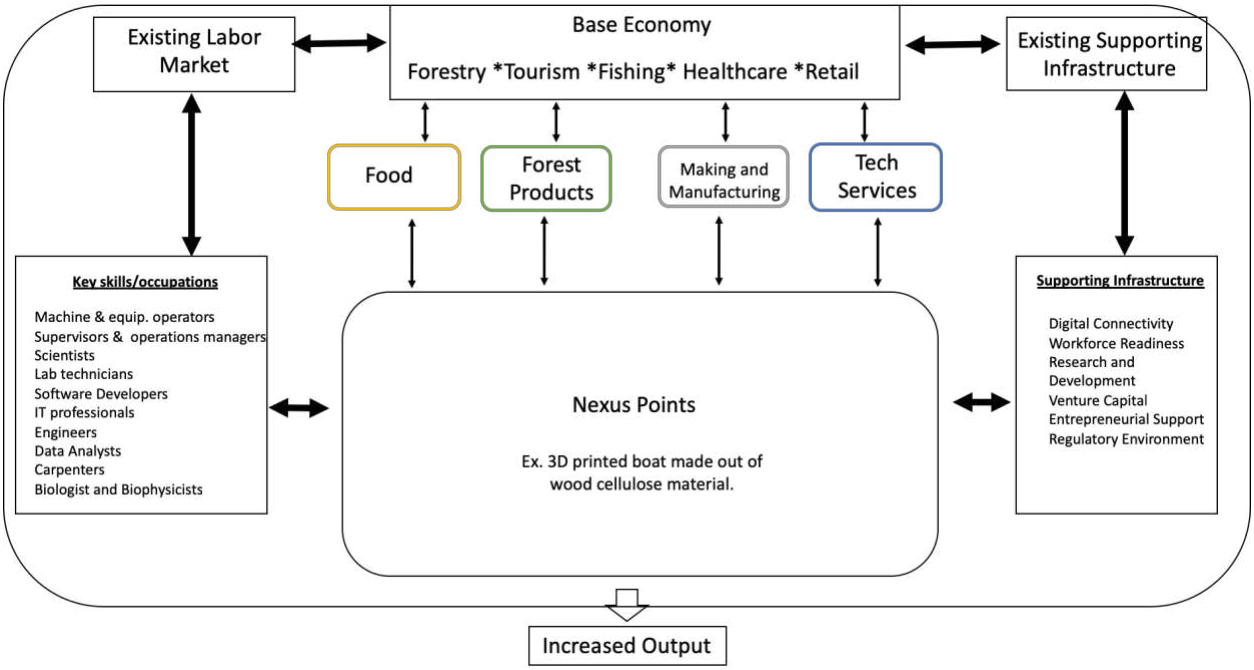

**Figure 2. Theory and Practice for Product Development at Nexus Points**