ECONOMIC IMPACT ASSESSMENT OF

M E X I N O L

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FOREWORD

These are the results of the research project "Economic Impact Assessment of Mexinol," carried out by the Universidad Autónoma de Sinaloa (UAS) through its Directorate General for Research and Postgraduate Studies – Technology Transfer Office. The study is the product of an agreement signed with Pacífico Mexinol, S. de R.L. de C.V. on October 19, 2025, and subsequently amended on January 5, 2026. It consists of an economic impact assessment of the investment in a methanol production plant in the municipality of Ahome, Sinaloa, Mexico.

A new investment particularly one of Mexinol's magnitude affects employment, income, production, gross fixed capital formation, and taxes not only at the local level but also across the wider regional and national economy. It is therefore highly advisable to estimate these intersectoral and regional effects in order to understand the potential changes in key economic variables and to plan actions that facilitate the best possible integration of the company into the local environment.

The overall objective of the project is to estimate the direct and indirect effects that Mexinol will have on the local economy in terms of employed population, production, contribution to Gross Domestic Product (GDP), taxes, and other variables.

To this end, a robust methodological approach was adopted to capture the multiple sectoral and regional effects of the phenomenon. A multidimensional analytical strategy was employed, combining three methodologies:

1. Input-Output Matrix (IOM)
2. Econometric Model (EM)
3. Machine Learning Model (ML)

The combination of three distinct methodologies converges on the estimation of results for the variable of employed personnel during the construction phase of the Mexinol plant. This convergence confirms the positive direct and indirect employment impacts of the investment, lending greater reliability to the results obtained.

Each methodology validated by scientific literature and global institutions was used to design and test matrix, econometric, and machine learning models, which ultimately led to the results presented here. The modelling illustrates the general benefits of the project and helps visualize the chain reaction of this new investment, since it estimates not only the direct and indirect jobs that the plant will create, but also the employment and income effects on the entire Sinaloa economy and the rest of the country.

We are grateful for the support of the Instituto Nacional de Estadística y Geografía (INEGI) for receiving us at their headquarters in Mexico City and providing the Input-Output Matrix databases; their assistance was fundamental. We also thank the Government of the State of Sinaloa for their cooperation during the course of this work.

We likewise thank the staff of the Universidad Autónoma de Sinaloa, as well as the liaisons and executives of Pacífico Mexinol who attended us; the assistance of everyone involved was invaluable in reaching these results.

Culiacán, Sinaloa, Mexico.

April 2026.

EXECUTIVE SUMMARY

Introduction

The objective of this study was to carry out an economic impact assessment of the investment by Pacífico Mexinol S. de R.L. de C.V., which consists of the construction and operation of a methanol production plant in northern Sinaloa, specifically in the municipality of Ahome, approximately 9 km from the Port of Topolobampo and near the natural gas pipeline originating in Texas, United States.

The initial investment in Mexico was estimated at MXN $31,755.2 million, allocated to the plant construction phase over a period of 4 years (2026–2030). This is a sustainable methanol production plant designed to produce green and blue methanol using state-of-the-art technologies such as NX-AdWinMethanol® Zero, which relies on renewable and environmentally friendly inputs. It will use natural gas, renewable electric energy (through Clean Energy Certificates), and wastewater from the city of Los Mochis, ensuring zero effluent discharge into Bahía de Ohuira.

The plant's installed capacity is 6,140 tons/day of methanol, of which 5,129 tons/day are Recycled Carbon Fuel (RCF) Methanol, 488 tons/day are Renewable Fuel of Non-Biological Origin (RFNBO) Methanol, and 523 tons/day are Ultra Low Carbon Intensity Methanol. The plant will use existing infrastructure at the Port of Topolobampo and will additionally construct new works to enable the use of its inputs and the transfer of methanol to specialized vessels arriving at the port.

Three methodologies were used for this economic impact assessment:

4. Input-Output Matrix (IOM)
5. Econometric Model (EM)
6. Machine Learning Model (ML)

The IOM was used to estimate the impacts during both the construction and operations phases of the plant. The EM and ML were used only to estimate the impacts during the construction phase. Using three distinct methodologies allowed for comparison and validation of estimates, which strengthens the study's findings.

I. Input-Output Matrix (IOM)

A bi-regional GDP Input-Output Matrix was used to quantify the economic impacts on two regions: Sinaloa and the Rest of the Country. In each region, impacts were broken down into four levels of proximity:

7. Direct Impacts: the immediate effects generated by the company's own activities within the region of origin (Sinaloa).
8. Indirect Impacts: the multiplier effect generated along the supply chain within the region of origin (Sinaloa), resulting from increased production by the company's local suppliers.
9. Spillover Impacts: the effects generated in a region other than where the company is located (Rest of the Country), derived from changes in the economic environment and the acquisition of inputs.

10. Feedback Impacts: the effects that return to the region of origin (Sinaloa) as a consequence of the spillover impact effects that leave the region of origin and eventually return.

For each of these four proximity levels, five economic variables were estimated:

a. Production: represents Gross Output Value (GOV) all goods and services produced, including those used in their manufacture.
b. Employed Population: the total number of people employed in the economy, commonly used as a proxy for employment.
c. GDP Contribution: quantifies the Value Added created by the productive process in the economy the difference between Gross Output Value and intermediate consumption.
d. Net Taxes on Products: the difference between taxes levied on production and imports (VAT, excise taxes, tariffs) and government subsidies to the company.
e. Employee Remuneration: the total wages and salaries paid to workers.

Impacts in Sinaloa - Construction Phase

Investment shock of MXN $28,579.7 million (90% of total investment allocated to Sinaloa)

Impact Type	Production (MXN millions)	Employed Population (jobs)	GDP Contribution (MXN millions)	Net Taxes on Products (MXN millions)	Employee Remuneration (MXN millions)
Direct	$20,696	17,996	$10,925	$47	$2,805
Indirect	$2,989	2,546	$1,539	$7	$405
Spillover	$65	64	$31	$0	$7
Feedback	$39	31	$20	$0	$5
TOTAL	**$23,789**	**20,637**	**$12,515**	**$54**	**$3,222**

- The construction of the Mexinol plant will have a total impact (over four years) on Sinaloa's production of MXN $23,789 million, and the employed population will grow by 20,637 persons.
- The Value Added in Sinaloa's economy from plant construction will be MXN $12,515 million, and net tax collection will be MXN $54 million.
- Total employee remuneration i.e., the increase in Sinaloa's wage bill from plant construction will be MXN $3,222 million.
- On average per year, the construction of the Mexinol plant will generate 4,499 direct jobs and 660 additional jobs from the combined indirect, spillover, and feedback effects in Sinaloa. All of these jobs are temporary and may vary depending on the construction sub-phase.

Impacts in the Rest of the Country – Construction Phase

Investment shock of MXN $3,175.5 million (10% of total investment allocated to the Rest of the Country)

Impact Type	Production (MXN millions)	Employed Population (jobs)	GDP Contribution (MXN millions)	Net Taxes on Products (MXN millions)	Employee Remuneration (MXN millions)
Direct	$12,743	14,594	$6,683	$74	$1,426
Indirect	$5,853	5,924	$2,761	$34	$618
Spillover	$9,188	7,418	$4,723	$20	$1,251
Feedback	$13	13	$6	$0	$1
TOTAL	**$27,798**	**27,950**	**$14,173**	**$127**	**$3,297**

- The construction of the Mexinol plant will have a total impact (over four years) on production in the Rest of the Country of MXN $27,798 million, and the employed population will grow by 27,950 persons.
- The Value Added in the Rest of the Country from plant construction will be MXN $14,173 million, and net tax collection will be MXN $127 million.
- Total employee remuneration in the Rest of the Country from plant construction will be MXN $3,297 million.
- On average per year, the construction of the plant will generate 3,648 direct jobs and 3,339 additional jobs from the combined effects in the Rest of the Country. All jobs are temporary and may vary by construction sub-phase.

Impacts in Sinaloa – Operations Phase

Annual investment shock of MXN $18,438.42 million (assuming 80% of installed capacity and a market price of USD $650/ton of methanol)

Impact Type	Production (MXN millions)	Employed Population (jobs)	GDP Contribution (MXN millions)	Net Taxes on Products (MXN millions)	Employee Remuneration (MXN millions)
Direct	$17,412.11	1,335	$13,029.04	$3.40	$161.75
Indirect	$844.38	106	$627.27	$0.34	$12.09
Spillover	$1.95	2	$1.00	$0.02	$0.23
Feedback	$2.52	1	$1.80	$0.00	$0.07
TOTAL	**$18,260.96**	**1,443**	**$13,659.11**	**$3.76**	**$174.14**

- The operation of the Mexinol plant will have an annual impact on Sinaloa's production of MXN $18,260.96 million, and the employed population will grow by 1,443 persons including 250 persons directly hired by the plant and 1,193 employed by companies in various sectors that supply inputs to the plant.
- The Value Added generated by the plant's operation will be MXN $13,659.11 million, and annual net tax collection will be MXN $3.76 million.

- The annual increase in Sinaloa's wage bill from the plant's operation will be MXN $174.14 million.

Impacts in the Rest of the Country - Operations Phase

Impact Type	Production (MXN millions)	Employed Population (jobs)	GDP Contribution (MXN millions)	Net Taxes on Products (MXN millions)	Employee Remuneration (MXN millions)
Direct	$700.06	892	$393.71	$8.99	$94.40
Indirect	$253.31	253	$124.33	$3.86	$29.09
Spillover	$1,041.39	205	$754.62	$1.21	$25.47
Feedback	$0.35	0	$0.18	$0.00	$0.04
TOTAL	**$1,995.12**	**1,350**	**$1,272.83**	**$14.07**	**$149.00**

- The operation of the Mexinol plant will have an annual impact on production in the Rest of the Country of MXN $1,995.12 million, and the employed population will grow by 1,350 persons.
- The Value Added in the Rest of the Country from the plant's operation will be MXN $1,272.83 million, and annual net tax collection will be MXN $14.07 million.
- The annual increase in the Rest of the Country's wage bill from the plant's operation will be MXN $149.00 million.

Employment Multipliers

Stage	Employment Multiplier	Interpretation
Construction	6	Mexinol will create 6 jobs in Sinaloa's economy for every direct construction job generated.
Operations	11	Mexinol will create 11 jobs in Sinaloa's economy for every direct operations job generated.
Average	**8**	**On average, Mexinol will create 8 jobs in Sinaloa for every job generated in construction and operations.**

- For every direct job generated by the construction of the Mexinol plant, 6 additional jobs will be created in the broader economy.
- For every direct job generated by the operation of the Mexinol plant, 11 additional jobs will be created in the broader economy.
- On average, for every job generated in both the construction and operations phases, 8 new jobs will be created.

II. Econometric Model (EM)

Following an econometric methodology and the Keynesian theoretical framework — which defines investment as the primary determinant of employment a model was developed with employed population (employment) as the dependent variable and GDP and Gross Fixed Capital Formation (GFCF) as the independent variables. The statistical sample used to validate the model covered four Mexican states (Baja California, Baja California Sur, Sinaloa, and Sonora) over the period 2007–2023 (17 years). A Panel Data (PD) technique was selected, integrating cross-sectional and time-series units, and the model was tested across three different statistical structures: POLS (Pooled Ordinary Least Squares), FE (Fixed Effects), and RE (Random Effects).

The model passed all statistical tests prescribed by the scientific literature. After introducing dummy variables to model the structural breaks identified in the data, the RE (Random Effects) model was selected for generating more consistent coefficients with the expected signs and for having the highest statistical representativeness, with $R^2 = 0.95$, meaning that GDP and GFCF explain 95% of employment creation.

The model results indicate that a 1% increase in GDP leads to a 0.89% increase in employment, while a 1% increase in GFCF generates a 0.03% increase in employment.

Jobs Generated by the Mexinol Investment

Applying the model results to the case of Sinaloa, an average of 7.95 jobs are created per million pesos of GFCF. Assuming that 90% of the plant construction investment will be located in Sinaloa (MXN $28,579 million), that 25% of this investment will convert to GFCF (MXN $7,144 million), and that labor accounts for 29.5% of non-residential construction costs (DOF, 2015), the following employment results were estimated:

- The total investment (4 years) in the construction of the Mexinol plant will generate 56,802 new jobs, including direct, indirect, spillover, and feedback effects.
- The total investment will generate 16,757 new direct jobs in Sinaloa during the construction phase.
- The Mexinol plant investment will generate an average of 4,189 direct jobs per year during the construction phase.

III. Machine Learning Model (ML)

This model quantifies the temporal trajectory of employment in the State of Sinaloa in response to an exogenous investment shock of MXN $31,755.2 million. The approach uses a hybrid architecture, comprising first a set of Machine Learning techniques, followed by a Vector Autoregressive system with Exogenous Variables (VARX).

This allows the model to measure not only the jobs generated, but also the time it takes for these jobs to materialize in the local economy. Such models can forecast two scenarios one without investment (inertial) and one with investment (exogenous) and the difference between these two scenarios quantifies the employment generated by the new investment.

The model was run using quarterly data for the period 2005-Q1 to 2025-Q2 a total of 82 quarters and 128 variables classified into the following groups: macroeconomics, capital flows, primary sector, secondary sector, tertiary sector, public finance, and business dynamism.

Machine Learning Model Results

- The inertial forecast indicates that at the end of the 16-quarter period there will be 1,540,416 employed persons, while the exogenous forecast projects 1,563,689 employed persons.
- The impact of the Mexinol investment during the plant construction phase will be 23,272 new jobs in Sinaloa.
- The Mexinol investment during the construction phase will generate an average of 5,818 jobs per year in Sinaloa, including direct, indirect, spillover, and feedback effects.
- According to the model, the variables that best predict employment in Sinaloa are: National Industrial Activity, Value of Production in Sinaloa, and Value of Production at the national level.

IV. Jobs Generated by the Mexinol Investment Across the Three Methodologies

The table below summarizes the main results in terms of employment across the three methodologies. Although the theoretical principles and statistical techniques applied by the three models were different, there is a clear convergence of results.

Model	Sinaloa 4-Year Total	Sinaloa Annual Avg.	Rest of Country 4-Year Total	Rest of Country Annual Avg.
Input-Output Matrix – Total	**20,637**	**5,159**	**27,950**	**6,988**
— Direct	17,996	4,499	14,594	3,649
— Indirect	2,546	637	5,924	1,481
— Spillover	64	16	7,418	1,855
— Feedback	31	8	13	3
Econometric Model – Total	**16,757**	**4,189**	**—**	**—**
Machine Learning Model – Total	**23,272**	**5,818**	**—**	**—**

- Total jobs (4 years) generated by the Mexinol investment in Sinaloa during the construction phase: 20,637 (IOM); 16,757 (Econometric Model); 23,272 (Machine Learning Model).
- Average annual jobs generated by the Mexinol investment in Sinaloa during the construction phase: 5,159 (IOM); 4,189 (Econometric Model); 5,818 (Machine Learning Model).
- According to the IOM, the construction phase over four years will generate 17,996 direct jobs, 2,546 indirect jobs, 64 spillover jobs, and 31 feedback jobs, totaling 20,637 new jobs.

- Due to regional interdependence (local and national), the construction phase will generate 27,950 jobs in the Rest of the Country over four years (direct + indirect + spillover + feedback).

V. New Permanent Jobs in Sinaloa (Construction + Operations)

New investment projects generate two types of employment: temporary jobs during the construction phase and permanent jobs during the operations phase. Temporary jobs last only for the duration of infrastructure construction, varying week by week or month by month depending on the sub-phase; permanent jobs last for the entire useful life of the plant.

To provide a combined view of both types of employment, a methodology was used to standardize jobs so they can be summed, thereby estimating the creation of permanent-equivalent jobs from the very beginning of the construction phase. Following Kammen et al. (2014) and Nasirov et al. (2021), in energy projects it is possible to estimate a factor to normalize jobs using the following formula:

Normalized jobs = [((construction time / 12) / useful life) × construction labor + operations labor] / installed capacity

To estimate the permanent jobs for Pacífico Mexinol, the direct employment results from the IOM were used for both the construction and operations phases. The construction phase spans 4 years, the plant's useful life is 30 years, and the installed capacity is 6,140 metric tons of methanol per day. Using these data, the following results were estimated:

Concept	Minimum	Average	Maximum
Permanent jobs created (annual average, over 34 years)	543	850	1,157

- This means that the Pacífico Mexinol investment in Sinaloa will generate an average equivalent of 850 permanent direct jobs per year, with a minimum of 543 and a maximum of 1,157 jobs.

Since these jobs are equivalent to permanent annual jobs over 34 years (4 construction + 30 operations), they reflect the long-term impact of Mexinol on Sinaloa's economy.

CHAPTER 1 Input-Output Matrix (IOM)

Introduction

The fundamental objective of this methodology is to quantify and evaluate the economic impact of the development and operations of the Mexinol project on various economic aggregates, including production, employed population, GDP contribution, net taxes on products, and employee remuneration. Given the magnitude of the project and its integration with national supply chains, the study measures not only the local effect, but also how the injection of capital and the demand for inputs propagate across the economy of the State of Sinaloa and the rest of Mexico.

Using a spatial approach, the study disaggregates impacts into four fundamental levels: direct impacts (intraregional), indirect impacts (intraregional), spillover impacts, and feedback impacts.

To analyze spatial interdependence, the model employs a bi-regional Sinaloa Input-Output Matrix (IOM), industry-by-industry, domestic transactions at current prices, with base year 2018. This matrix explicitly models commercial transactions between Sinaloa and the rest of the country.

The multiplicative formulation of Pyatt and Round (1979) and the additive decomposition of Stone (1985) are applied to this structure. This advanced mathematical technique decomposes the global Leontief multiplier to precisely isolate and quantify the proportion of the productive impact that remains in the region of origin, how much filters out to other regions, and how much returns. This approach ensures precise measurement of economic spillovers, avoiding the overestimation that often occurs in single-region models.

The bi-regional model is framed under the classical assumptions of fixed proportions, and its main limitations include: constant technical coefficients, constant returns to scale, availability of productive factors, static nature, and sectoral homogeneity.

Methodology

The Input-Output Matrix (IOM) reflects the economic relationships among the various sectors and agents participating in all phases of the economic cycle. The analysis maps and quantifies how all productive sectors interact showing exactly what each industry purchases from and sells to all others in order to operate and produce its final products. Thus, a country's IOM provides valuable information for evaluating the aggregate effect on the economic system of certain exogenous shocks that initially affect a particular activity.

The Instituto Nacional de Estadística y Geografía (INEGI) produces national matrices, which serve as inputs for input-output analyses. INEGI also produces, through the implementation of Walter Isard's model (1951), state and multi-state Input-Output Matrices, thereby incorporating the spatial component into the input-output analysis.

The bi-regional IOM used shows how Sinaloa conducts economic interactions with the rest of the country specifically the industry-by-industry matrix with base year 2018, using domestic transactions at current prices.

The construction of the Mexinol plant is a highly complex industrial infrastructure, characterized by capital intensity and requirements for highly specialized labor. The original employed population coefficient for the construction sector was therefore adjusted. Originally this coefficient reflects a state and national average heavily influenced by the residential construction subsector (housing and commercial), which is intensive in traditional labor and

represents lower labor productivity indices. The adjustment ensures that estimates are more realistic.

Industrialized, technology-intensive construction methods generate a labor productivity increase of between 20% and 40% (McKinsey Global Institute, 2017). It was assumed that productivity in the construction of the Mexinol plant will be 40% higher than the average productivity of housing and general construction. This adjustment ensures that direct employment estimates are not overstated and accurately reflect the technical and specialized nature of the project.

Investment Breakdown

Of the project's global investment, it was estimated that 46% will occur in Mexico (the average percentage provided by the company). Therefore, the effective investment in the plant construction phase is USD $1,814 million, to be executed over 48 months (4 years). A total of 90% of this investment is assumed to occur in Sinaloa and 10% in the Rest of the Country, since the construction sector has the characteristic of anchoring capital, causing its greatest impact at the local level.

Construction Phase Results – Sinaloa (Year by Year)

Year 1 (investment shock of MXN $5,233.52 million): Direct effects of MXN $3,790 million in production, 3,295 employed persons, MXN $2,001 million in Value Added, MXN $9 million in net taxes, and MXN $514 million in wages. Total including all effects: $4,356 million, 3,779 employed, $2,292 million VA, $10 million taxes, $590 million wages.

Year 2 (investment shock of MXN $12,253.55 million): Direct effects of MXN $8,873 million in production, 7,716 employed persons. Total: $10,200 million, 8,848 employed.

Year 3 (investment shock of MXN $8,429.90 million): Direct effects of MXN $6,105 million in production, 5,308 employed persons. Total: $7,017 million, 6,087 employed.

Year 4 (investment shock of MXN $2,662.72 million): Direct effects of MXN $1,928 million in production, 1,677 employed persons. Total: $2,216 million, 1,923 employed.

4-Year Total (investment shock of MXN $28,579.69 million): Direct employment of 17,996 persons; indirect employment of 2,546; spillover of 64; feedback of 31; total 20,637 employed persons.

Operations Phase Results - Sinaloa

The annual investment shock for the operations phase was MXN $18,438.42 million (80% of installed capacity at USD $650/ton market price). The 250 persons directly employed by the plant are included in the 1,335 direct jobs, and the remainder work in supply chain sectors. These impacts are considered constant throughout the plant's 30-year useful life.

Chapter 1 Conclusions

The development of the Mexinol plant in Sinaloa represents a high-value catalyst for the regional and national economy. Through the bi-regional Input-Output Matrix methodology, it has been quantified how the investment and operations will permeate through various value chains over a four-year period. The results demonstrate a capital injection with a robust and sustained multiplier effect. Mexinol will act as a strategic development engine, consolidating supply chains and generating tangible long-term economic benefit.

CHAPTER 2 Econometric Model (EM)

Introduction

Using an econometric methodology, the impact of the Pacífico Mexinol investment on employment was evaluated. The employed population was used as the dependent variable, and Gross Fixed Capital Formation (GFCF) and GDP as the independent variables.

A Panel Data (PD) methodology was employed, integrating cross-sectional and time-series units. The sample covers four states (Baja California, Baja California Sur, Sinaloa, and Sonora) for the period 2007–2023. Three model structures were tested: POLS (Pooled OLS), FE (Fixed Effects), and RE (Random Effects).

The theoretical support of the model is rooted in employment theory and its determinants. The Keynesian economic theory holds that employment is involuntary and wages are rigid, and attributes unemployment to variables that stimulate labor demand, including investment, GDP, consumption, and exports.

Methodology and Statistical Tests

Log-log models were estimated to obtain a linear regression. Unit root tests (ADF, PP, and KPSS) confirmed that all variables are non-stationary at levels but stationary in first differences i.e., integrated of order I(1). The Gregory-Hansen cointegration method, which is robust to structural breaks, confirmed that the variables cointegrate.

The RE (Random Effects) model was selected following the Hausman test (which accepted the null hypothesis of no endogeneity), the Breusch-Pagan test (which rejected POLS in favor of RE), and the test of redundant fixed effects (which confirmed that fixed effects were not needed). A dummy variable was introduced for Sinaloa 2023 to address a detected structural break. Heteroskedasticity and autocorrelation were corrected using Arellano-type robust standard errors.

Estimated Equation

$$\mathbf{Employment(it) = 1.88 + 0.89 \cdot GDP(it) + 0.03 \cdot GFCF(it)}$$

The goodness of fit of the model is $R^2 = 0.95$, meaning that GDP and GFCF explain 95% of employment variation. A 1% increase in GDP leads to a 0.89% increase in employment; a 1% increase in GFCF leads to a 0.03% increase in employment.

Results Applied to Mexinol

An average of 7.95 jobs are generated per million pesos invested in GFCF in Sinaloa. Applying this coefficient to the Mexinol investment with 90% of the total investment in Sinaloa (MXN $28,579 million), 25% of which converts to GFCF (MXN $7,144 million), and 29.5% labor share in non-residential construction yields the following results:

- Total jobs generated in Sinaloa and Rest of Country by GFCF investment: 63,113
- Jobs generated in Sinaloa (90% of investment): 56,802
- Direct jobs in Sinaloa over 4 years of construction: 16,757
- Average direct jobs per year: 4,189

Chapter 2 Conclusions

Following national criteria — that GFCF represents 25% of GDP and that 29.5% of non-residential construction costs go to labor — the total direct employment generated by an investment of Pacífico Mexinol's magnitude in the State of Sinaloa is approximately 4,189 jobs per year throughout the 4-year construction phase.

CHAPTER 3 - Machine Learning Model (ML)

Introduction

This methodology quantifies the temporal trajectory of employment in the State of Sinaloa in response to an exogenous investment shock equivalent to USD $1,814 million from the development of the Mexinol plant. While the Input-Output methodology provides a static, structural snapshot of intersectoral multipliers, this analysis captures the dynamic effects of the economy. The approach uses a hybrid architecture: first Machine Learning techniques, then a Vector Autoregressive system with Exogenous Variables (VARX).

The model allows the estimation of not only the jobs generated but also the time these jobs take to materialize in the local economy. Such models forecast two scenarios inertial (without investment) and exogenous (with investment) and the difference between them quantifies the employment generated by the new investment.

Methodology

The database spans from Q1 2005 to Q2 2025, encompassing 82 quarters and 128 variables classified into: macroeconomics, capital flows, primary sector, secondary sector, tertiary sector, public finance, and business dynamism. Sources include INEGI, Banco de México, ENOE, Data México (Secretaría de Economía), SADER, CONAGUA, SEMAR, and the Secretaría de Comunicaciones y Transportes.

Dimensionality Reduction

To handle the high dimensionality of 128 variables, a Machine Learning approach was used:

11. Hierarchical Clustering (Ward method): Variables were grouped using a Spearman correlation-based distance matrix, yielding 16 groups of variables with similar economic information. This allows one representative per group to be selected.
12. Elastic Net Regularization: A penalized regression was optimized over the generated groups using k-fold cross-validation to find optimal L1 (LASSO) and L2 (Ridge) hyperparameters. Elastic Net combines both to identify the subset of predictors with the highest explanatory power.

VARX Engine and Simulation

The optimal variable subset selected by the Elastic Net algorithm formed a VARX system (Sims, 1980; Kilian, 2006) with an optimal lag of p=1 to preserve degrees of freedom. The Mexinol capital injection was modeled as an exogenous variable introduced into the system. The Orthogonalized Impulse Response Function (OIRF), with Cholesky decomposition, measured the marginal and cumulative effect of capital on net employment creation over a 16-quarter simulation horizon.

Results

An exogenous capital injection of USD $1,814 million was assumed, converted at MXN $17.50 per dollar, distributed equally over 16 quarters (construction period). Two prediction scenarios were modeled:

- Inertial forecast (without investment): 1,540,416 employed persons at the end of 16 quarters
- Exogenous forecast (with Mexinol investment): 1,563,689 employed persons
- Difference Mexinol's employment impact: 23,272 new jobs in Sinaloa over the construction phase
- Average annual jobs generated: 5,818

Employment evolution by year (cumulative totals at year-end, per ML model):

Year	Cumulative Net Jobs
Year 1	11,372
Year 2	16,605
Year 3	19,823
Year 4	**23,272**
Annual Average	**5,818**

According to the Elastic Net, the variables that best predict employment in Sinaloa are: National Industrial Activity, Value of Production in Sinaloa, and Value of Production at the national level.

Chapter 3 Conclusions

The hybrid dynamic modelling (ML + VARX) converges with the estimates from the input-output and econometric models. The Pacífico Mexinol project has strong regional catalytic capacity. The investment in the construction of the methanol plant over 4 years will generate 23,272 formal jobs in Sinaloa, equivalent to an average of 5,818 jobs per year.

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ANNEXES

Notes on the Econometric Model

The estimated model assumes that structural differences between states remain constant. A random effects model in the temporal dimension was estimated. GFCF data are expressed in current market prices (inclusive of inflation for the period). Statistical tests for the model estimates and variable series can be consulted in the cited references. R-Studio software was used for all estimations and diagnostic tests.

Notes on the Calculation of Jobs Generated - Pacífico Mexinol

The GFCF data used in the model contain both public and private investment across all sectors. Therefore, the model's resulting indicator represents jobs per million pesos invested in GFCF within that context.

The model results are adapted to an investment of Pacífico Mexinol's magnitude within the context of the State of Sinaloa, using Sinaloa's employment and GFCF data.

To approximate direct jobs, national and general criteria were applied:

13. GFCF approximates 25% of GDP (per INEGI). From the macroeconomic standpoint, investment is referred to as Gross Fixed Capital Formation (GFCF), comprising increases in productive assets in terms of capital goods (infrastructure, equipment, or inventories) and hired labor.
14. To approximate the share of labor in non-residential construction, the criteria of the Diario Oficial de la Federación (DOF, 2025) were applied, setting the labor cost share at 29.5%.