Emsi Impact Analysis
The Floating Island Project

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Emsi

Contents

Introduction

THE Seasteading Institute and spin-off company Blue Frontiers propose to develop a semi-autonomous community within the territorial waters of French Polynesia. This proposed project, dubbed "The Floating Island Project," includes a land zone and a sea zone.[1] The sea zone would be located in a lagoon off the coast of Tahiti and is comprised of a series of state-of-the-art, environmentally sound floating platforms, or "islands," with all of the necessary infrastructure to support a community at sea. The land zone would be located on Tahiti, adjacent to the lagoon, and could include up to 40 hectares (98.8 acres) of land to accommodate a number of uses to serve the sea zone. The Floating Island Project also includes the formation of a special economic zone (SEZ) that would encompass both the land zone and sea zone.[2]

On January 13, 2017, the French Polynesian government signed an official Memorandum of Understanding (MOU) with the Seasteading Institute to cooperate on the development of The Floating Island Project.[3] The MOU obligates The Seasteading Institute to provide an economic analysis of the proposed project to demonstrate the potential economic benefits for French Polynesia. To fulfill this obligation, The Seasteading Institute and Blue Frontiers hired Economic Modeling Specialists International (Emsi), a third-party, independent economic consulting firm, to build an economic impact model to conduct such an analysis.[4] This report provides a summary of Emsi's findings.

1 For more information see: https://www.seasteading.org/floating-islands-project-in-french-polynesia/.

2 A special economic zone (SEZ) is an area in which business and trade laws are different from the country they are located within and their aim is increased trade, increased investment, ease of job creation, and efficient administration. For more information see: Akinci, Gokhan; Crittle, James. 2008. Special economic zone: performance, lessons learned, and implication for zone development. Foreign Investment Advisory Service (FIAS) occasional paper. Washington, DC: World Bank. Online source: http://documents.worldbank.org/curated/en/343901468330977533/Special-economic-zone-performance-lessons-learned-and-implication-for-zone-development

3 For more information see: https://www.seasteading.org/2017/01/government-french-polynesia-signs-agreement-seasteaders-floating-island-project/.

4 See Appendix B to learn more about Emsi.

Input-Output Models

A PRIMARY tool used by regional economists to estimate the potential economic impacts of proposed changes to the economy is a regional input-output (I-O) model. Built on a platform of economic and employment data, a regional I-O model is a mathematical representation of the flow of money in a regional economy, primarily among industries,[5] while also accounting for the effects of government, households, and regional imports and exports. They are called "input-output" models due to the fact that a portion of the output (i.e., sales) of one industry will appear as the input (i.e., purchases) of other industries.[6]

Once the flow of money is represented by a regional I-O model, a user can introduce events that change the flow (e.g., a gain of jobs or increase of sales in one industry) and automatically simulate the potential effects of said event on each industry in the region, as well as the region as a whole due to the interconnectedness of the industries, households, and government entities that occupy that region. A regional I-O model therefore indicates how a change in one part of the economy will ultimately affect other parts of the economy based on these purchasing and selling relationships.

When using a regional I-O model, the estimated effects of an event (i.e., the economic impact) are determined by using economic "multipliers." Economic multipliers are numeric values, calculated during the construction of a regional I-O model, that represent how much a change to one industry in a regional economy will impact the other industries in that region. So if an industry has a multiplier of 2.5, for every positive or negative change to that industry, the total effect on the regional economy will be 2.5 times the original change. While there are many different multipliers used by regional economists, sales multipliers, jobs multipliers, and earnings multipliers are the most common. For example, if an industry has a jobs multiplier of 3.0, adding 100 jobs to that industry would lead to a total change of 300 new jobs (3.0 × 100 = 300) in the regional economy.

In the previous example, note that the total change of 300 jobs included the original 100 jobs, meaning the additional change is 200 jobs. The original jobs are called the "initial" effect, while the additional jobs are commonly referred to as the "ripple effects." These ripple effects represent two additional regional economic impacts – "direct effects" and "indirect effects." Direct effects are intra-industry effects, representing additional changes (sales, jobs, or earnings) within the initially impacted industry, resulting from the initial change. Indirect effects are supply chain effects, representing additional changes (sales, jobs, or earnings) within other industries in the regional economy, resulting from both the initial and direct effects.

For example, a local company begins exporting a new product (sales), resulting in "outside" money

5 An industry is a group of business establishments that share similar end-products (or services) and processes for creating those products (or services).

6 For more information about Input-Output models see: Robison, M. Henry. 2009. *Input-Output Guidebook: A practical guide for regional economic impact analysis.* Moscow, ID: Economic Modeling Specialists International. Online source: http://www.economicmodeling.com/wp-content/uploads/emsi-io-guide-1.pdf.

being brought into the region. This new injection of money enables the company to purchase more local supplies, hire more local employees, and so on (i.e., direct effects). Due to the increased activity of this company, local suppliers have more business – so they too are likely purchase more local supplies, hire more local employees, and so on (i.e., indirect effects). With each transaction (i.e., "ripple") some money "leaks out" of the economy, most commonly in the form of imports or wages to non-local employees, eventually exhausting the impact from the initial change. The summation of the money spent inside the region during each of these transactions is the total effect.

Emsi's Approach

EMSI determined that the best way to demonstrate the potential economic benefits of The Floating Island Project for French Polynesia was to use a regional input-output model. Due to the uniqueness of The Floating Island Project – and the fact that no other regional I-O model for French Polynesia exists with the level of granularity required for such an analysis – Emsi built a custom I-O model for this economic impact analysis. The custom I-O model for French Polynesia is based on standard input-output methodologies.[7] The data required to build the model were collected from the "tableaux des ressources et des emplois" (TRE) (tables of resources and jobs), a dataset produced by the Institut de la statistique de la Polynésie française (iSPF) (Institute of Statistics of French Polynesia).[8]

The custom I-O model built by Emsi quantifies the potential economic impacts that The Floating Island Project could have on the French Polynesian economy (in terms of increased jobs, earnings, and sales) by simulating the initial effects and ripple effects of the project. Additionally, because it is expected that most of the materials, goods, and services purchased for The Floating Island Project will come from outside the SEZ, the custom I-O model also quantifies the potential fiscal impacts (in the form of tax revenue) that could be generated by those purchases for the French Polynesian government. By quantifying both the economic and fiscal impacts, the custom I-O model built by Emsi better estimates the total potential impact that The Floating Island Project could have on the French Polynesian economy.

Once the custom I-O model was built, Emsi met with representatives from the iSPF so they could review the inner workings and output of the model to ensure that nothing was outside of the scope of economic reality for French Polynesia. Through this process, the representatives from the iSPF provided feedback on the model and clarification on some aspects of the data collected from the TRE so that Emsi could make adjustments as needed and finalize the model. Emsi had also hoped to compare the outputs from the custom I-O model with the outputs from a model used by the iSPF, but the custom I-O provides a higher level of granularity, with respect to the industry sectors it represents, than the iSPF model, thus the outputs from each are not one-to-one and cannot be compared. While the representatives from iSPF were unable to "validate" Emsi's final custom I-O model, they did come to the consensus that the model provides an appropriate representation of the flow of money in the French Polynesian economy.

7 See Appendix A for more detail on Emsi's I-O methodology.

8 Online source: http://www.ispf.pf/themes/EconomieFinances/Comptesconomiques/Details.aspx. Accessed 4.27.2017.

Estimating Potential Short-Term and Long-Term Impacts

WHEN estimating potential economic impacts of The Floating Island Project, Emsi accounted for both the short-term impacts that will be generated by the development and construction activities resulting from the project and the long-term impacts that will be generated by the ongoing operations and habitation of the land zone and sea zone. It is important to make this distinction because, as the name suggests, short-term impacts are only temporary. Once the construction activity for the project is completed, the ripple effects resulting from it will be exhausted and the economy will return to equilibrium. On the other hand, long-term impacts will remain in the economy so long as The Floating Island Project remains operational, creating a new equilibrium point for the economy.

The Floating Island Project Impact Scenarios

IN an effort to more accurately portray the potential impacts of The Floating Island Project, Emsi divided the project into three phases to represent the likely progression of the project over time. To account for both the short-term and long-term impacts of these phases, Emsi worked with The Seasteading Institute and Blue Frontiers to establish a likely construction and operations impact scenario for each. Once complete, The Floating Island Project impact scenarios were run through the custom I-O model.

Before getting into the results of this analysis, there are two important factors that readers of this report should consider:

- While the numerical values presented in the following sections are detailed, suggesting a high level of accuracy, they represent estimations that were generated by the custom I-O model and should only be regarded as such.
- As The Floating Island Project progresses, more jobs will be created within the SEZ than can be held by the residents of the land and sea zones, and even more jobs will be created or supported outside of the SEZ, thus providing numerous job opportunities for French Polynesians. When this analysis refers to jobs, it is assumed that both the residents of The Floating Island Project and French Polynesians will occupy them.

The following sections introduce the three project phases, describe their corresponding construction and operations scenarios, and quantify the potential short-term and long-term impacts of each.

PROJECT PHASE 1

It is anticipated that legislation for The Floating Island Project, which will also establish the special economic zone (SEZ), will be in place by the end of 2017, and that a pilot phase (Phase 1) of the project will commence in early 2018.

Phase 1: Short-Term Construction Scenario (Temporary Impacts)

For Phase 1 of the project, The Seasteading Institute and Blue Frontiers are proposing to construct 10 large floating platforms (25m × 25m) and 5 small floating platforms (14m × 14m) to create the first group of islands that will occupy the sea zone. These first islands will include residential units, work spaces, research facilities, and communal spaces. A high-end restaurant that can accommodate up to 100 patrons per night and a 30-room boutique lodging facility will also be included in the first group of islands. The estimated construction cost for these Phase 1 islands is $4,000 USD (428,000 XPF) per square meter.

The Seasteading Institute and Blue Frontiers are proposing to develop 5 hectares (12.4 acres) of

land to create the first section of the land zone during Phase 1. This first section of the land zone will include a staging area for platform construction, additional residential units, a "makerspace,"[9] and the first of the infrastructure needed to support the sea zone. The estimated development cost for the Phase 1 land zone is $425 USD (45,475 XPF) per square meter.

It is estimated that the Phase 1 construction scenario will take two years to complete and will cost $50 million USD (5.4 billion XPF) – all of which will be provided by investors. This temporary injection of outside money into the French Polynesian economy is expected to stimulate a total of $171 million USD (18.3 billion XPF) in sales during construction. It is estimated that these new sales will create or support a total of 819 jobs and generate $28 million USD (3.0 billion XPF) in wages during the two-year construction period. Furthermore, the sales activity resulting from this construction scenario is expected to produce a total of $10 million USD (1.1 billion XPF) in tax revenue for French Polynesia. See Table 1 for more details.

TABLE 1: Estimated Economic Impacts Resulting from 2 Years of Construction during Phase 1

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	344	$50.2	$9.1	$59.3	$0.0
Ripple Effects	474	$120.8	$18.6	$139.4	$9.9
Total Impact	819	$171.0	$27.7	$198.7	$9.9

Source: Emsi, custom I-O for French Polynesia, 2017

Note: Values may not sum to total due to rounding

Phase 1: Long-Term Operations Scenario (Annual Impacts)

The operations scenario for Phase 1 begins at year three, when it is assumed that the facilities constructed for the land and sea zones will be fully occupied. Although it is likely that some residents and businesses will begin occupying the land zone, and possibly even the sea zone, before year three – thus generating some preliminary operations impacts – this operations scenario does not attempt to quantify them.

It is assumed that the high-end restaurant will average $70 USD (7,490 XPF) per patron and the boutique lodging facility will have an average nightly rate of $950 USD (101,650 XPF). For this operations scenario, it is assumed that the high-end restaurant will only fill to 60% of capacity during Phase 1, thus having an annual revenue potential of $1.5 million USD (164 million XPF).[10] It is also assumed that the boutique lodging facility will only fill to 60% of capacity during Phase 1, holding its annual revenue to $6.2 million USD (668 million XPF).[11]

9 A makerspace is a community-operated workspace where people with common interests can meet, socialize, and collaborate. Adapted from: https://www.makerspaces.com/what-is-a-makerspace/. Accessed 6.14.2017.

10 100 patrons × $70 USD (7,490 XPF) per patron × 365 days per year × 60% capacity = $1.5 million USD (164 million XPF).

11 30 rooms × $950 USD (101,650 XPF) × 365 days per year × 60% capacity = $6.2 million USD (668 million XPF).

Together, the high-end restaurant and boutique lodging facility are estimated to generate $7.8 million (832 million XPF) in annual revenue during Phase 1 of The Floating Island Project. This revenue is expected to stimulate an additional $19.2 million USD (2.1 billion XPF) in sales, bringing their total annual sales impact to $27.0 million USD (2.9 billion XPF). This sales impact will create or support a total of 196 jobs each year, generate $6.2 million USD (665 million XPF) in annual wages, and produce $1.6 million USD (168 million XPF) in annual tax revenue for French Polynesia. See Table 2 for more details.

TABLE 2: Estimated Annual Economic Impacts Resulting from Restaurant and Lodging Operations during Phase 1

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	111	$7.8	$3.0	$10.7	$0.0
Ripple Effects	85	$19.2	$3.2	$22.5	$1.5
Total Impact	196	$27.0	$6.2	$33.2	$1.6

Source: Emsi, custom I-O for French Polynesia, 2017

Note: Values may not sum to total due to rounding

The other facilities constructed for the land and sea zones during Phase 1 are assumed to house a variety of businesses, across multiple industries, with enough capacity to support 100 workers (jobs) annually. It is assumed that these jobs will include maintenance, technical and scientific researchers, software development, administrative and clerical, accounting and finance, legal services, transportation, management and operations, and real estate workers. In total, an estimated 387 jobs will be created or supported annually by these initial 100 jobs during Phase 1 (excluding jobs associated with the high-end restaurant and boutique lodging facility). This will generate $16.1 million USD (1.7 billion XPF) in annual wages, $89.6 million USD (9.6 billion XPF) in annual sales, and $5.2 million USD (561 million XPF) in annual tax revenue for French Polynesia. See Table 3 for more details.

TABLE 3: Estimated Annual Economic Impacts Resulting from Business Operations during Phase 1

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	100	$23.6	$4.5	$28.1	$0.5
Ripple Effects	287	$66.0	$11.6	$77.6	$4.8
Total Impact	387	$89.6	$16.1	$105.7	$5.2

Source: Emsi, custom I-O for French Polynesia, 2017

Note: Values may not sum to total due to rounding

Altogether, Phase 1 operations of The Floating Island Project are estimated to create or support a total of 583 jobs annually. This will generate $22.3 million USD (2.4 billion XPF) in annual wages, $116.6 million USD (12.5 billion XPF) in annual sales, and $6.8 million USD (729 million XPF) in annual tax revenue for French Polynesia. See Table 4 for more details.

TABLE 4: Estimated Annual Economic Impacts Resulting from All Operations during Phase 1

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	211	$31.4	$7.4	$38.9	$0.5
Ripple Effects	372	$85.2	$14.8	$100.1	$6.3
Total Impact	583	$116.6	$22.3	$138.9	$6.8

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Figures 1 and 2 show the estimated impacts to jobs (Figure 1), and sales, wages, and taxes (Figure 2) from construction and operations during the first five years of Phase 1. For display purposes, the total impacts from the two-year construction period were divided evenly over years 1 and 2 of Phase 1.

FIGURE 1: Construction and Operations Impacts on Jobs from Phase 1

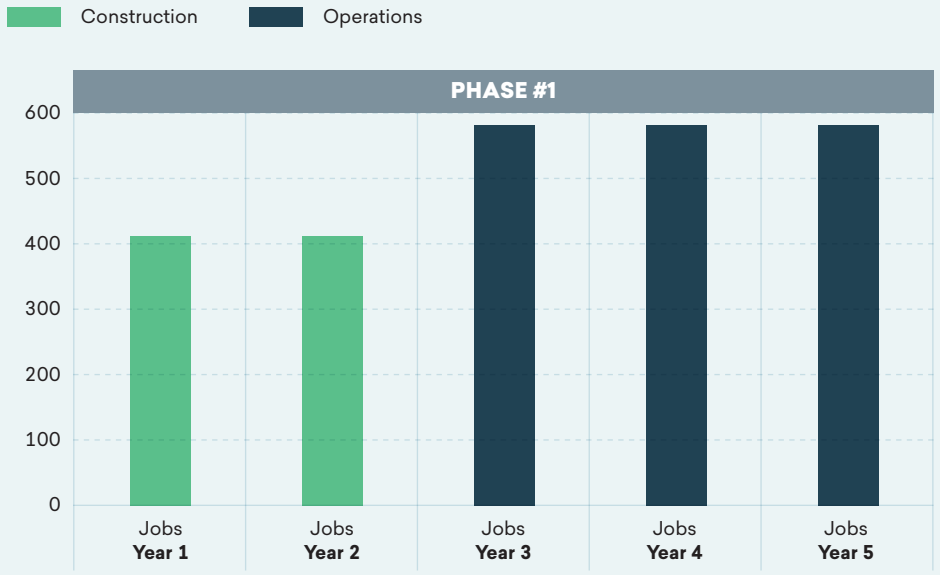
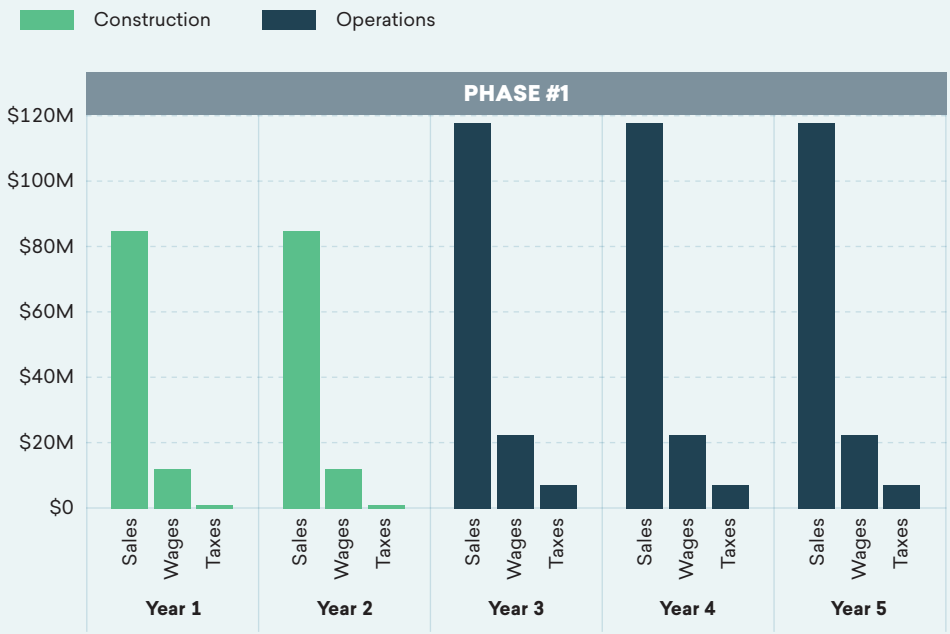


FIGURE 2: Construction and Operations Impacts on Sales, Wages, and Taxes from Phase 1



PROJECT PHASE 2

After successfully operating Phase 1 for a number of years, it is assumed that The Floating Island Project will be ready for growth. This will require the construction of more floating platforms (to create a second group of islands in the sea zone) and the development of more land to expand the land zone.

Phase 2: Short-Term Construction Scenario (Temporary Impacts)

For Phase 2 of The Floating Island Project, it is assumed that an additional 10 large floating platforms (25m × 25m) and 5 small floating platforms (14m × 14m) to create a second group of islands that will occupy the sea zone. These islands will include more residential units, work spaces, research facilities, communal spaces, and an advanced healthcare facility. It is assumed that the knowledge and skills gained by the construction workers during Phase 1, and the infrastructure that is already in place from Phase 1 will decrease the platform construction costs by 15%, lowering them to $3,400 USD (363,800 XPF) per square meter.

It is also assumed that an additional 5 hectares (12.4 acres) of land will be developed to expand the land zone during Phase 2. This expanded section of the land zone will include more residential units, expanded support infrastructure, and an advanced agricultural facility. It is assumed that

the development costs for the Phase 2 land zone expansion will match the Phase 1 costs; $425 USD (45,475 XPF) per square meter.

It is estimated that the Phase 2 construction scenario will take three years to complete and will cost $45.8 million USD (4.9 billion XPF). This second large investment into the French Polynesian economy is expected to stimulate a total of $156.2 million USD (16.7 billion XPF) in sales during Phase 2 construction. It is estimated that these new sales will create or support a total of 748 jobs, generate $25.3 million USD (2.7 billion XPF) in wages, and produce a total of $9.0 million USD (964 million XPF) in tax revenue for French Polynesia during the three-year construction period. See Table 5 for more details.

TABLE 5: Estimated Economic Impacts Resulting from 3 Years of Construction during Phase 2

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	315	$45.8	$8.3	$54.1	$0.0
Ripple Effects	433	$110.4	$17.0	$127.4	$9.0
Total Impact	748	$156.2	$25.3	$181.5	$9.0

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Phase 2: Long-Term Operations Scenario (Annual Impacts)

The operations scenario for Phase 2 begins at year four, when it is assumed that the additional facilities constructed for the land and sea zones will be fully occupied. As was the case for the Phase 1 operations scenario, this scenario does not attempt to quantify preliminary operations impacts as residents and businesses begin occupying the new facilities prior to the completion of Phase 2 construction. However, during the three-year construction period of Phase 2, The Floating Island Project will remain operational, continuing to contribute to the French Polynesian economy as previously described.

During Phase 2, it is still assumed that the high-end restaurant will average $70 USD (7,490 XPF) per patron and the boutique lodging facility will have an average nightly rate of $950 USD (101,650 XPF), but for this operations scenario, it is assumed that the high-end restaurant will now fill to 85% of capacity during Phase 2, thus having an annual revenue potential of $2.2 million USD (232 million XPF).[12] It is now assumed that the boutique lodging facility will also fill to 85% of capacity during Phase 2, thus having an annual revenue to $8.8 million USD (946 million XPF).[13]

Together, the high-end restaurant and boutique lodging facility are estimated to generate $11.0 million (1.2 billion XPF) in annual revenue during Phase 2 of The Floating Island Project. This rev-

12 100 patrons × $70 USD (7,490 XPF) per patron × 365 days per year × 85% capacity = $2.2 million USD (232 million XPF).
13 30 rooms × $950 USD (101,650 XPF) × 365 days per year × 85% capacity = $8.8 million USD (946 million XPF).

enue is expected to stimulate an additional $27.2 million USD (2.9 billion XPF) in sales, bringing their total annual sales impact to $38.3 million USD (4.1 billion XPF). This sales impact will create or support a total of 278 jobs each year, generate $8.8 million USD (942 million XPF) in annual wages, and produce $2.2 million USD (238 million XPF) in annual tax revenue for French Polynesia. See Table 6 for more details.

TABLE 6: Estimated Annual Economic Impacts Resulting from Restaurant and Lodging Operations during Phase 2

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	157	$11.0	$4.2	$15.2	$0.1
Ripple Effects	121	$27.2	$4.6	$31.8	$2.2
Total Impact	278	$38.3	$8.8	$47.1	$2.2

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

For this operations scenario, it is assumed that the new facilities constructed during Phase 2 will also house a variety of businesses, across multiple industries. With this new growth, the land sea zones are assumed to now have enough capacity to support 275 workers (jobs) annually. It is assumed that the Phase 2 jobs will still include maintenance, technical and scientific researchers, software development, administrative and clerical, accounting and finance, legal services, transportation, management and operations, and real estate workers, but now healthcare and agriculture workers will also be included. In total, an estimated 973 jobs will be created or supported annually by these initial 275 jobs during Phase 2 (excluding jobs associated with the high-end restaurant and boutique lodging facility). This will generate $40.1 million USD (1.1 billion XPF) in annual wages, $228.2 million USD (24.4 billion XPF) in annual sales, and $15.1 million USD (1.6 billion XPF) in annual tax revenue for French Polynesia. See Table 7 for more details.

TABLE 7: Estimated Annual Economic Impacts Resulting from Business Operations during Phase 2

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	275	$68.4	$12.1	$80.5	$2.6
Ripple Effects	698	$159.8	$28.0	$187.8	$12.5
Total Impact	973	$228.2	$40.1	$268.3	$15.1

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Altogether, Phase 2 operations of The Floating Island Project are estimated to create or support a total of 1,250 jobs annually. This will generate $48.9 million USD (5.2 billion XPF) in annual wages, $266.4 million USD (28.5 billion XPF) in annual sales, and $17.3 million USD (1.9 billion XPF) in annual tax revenue for French Polynesia. See Table 8 for more details.

TABLE 8: Estimated Annual Economic Impacts Resulting from All Operations during Phase 2

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	432	$79.4	$16.3	$95.7	$2.6
Ripple Effects	818	$187.0	$32.6	$219.6	$14.7
Total Impact	1,250	$266.4	$48.9	$315.4	$17.3

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Figures 3 and 4 show the estimated impacts to jobs (Figure 3), and sales, wages, and taxes (Figure 4) from construction and operations during the first five years of both Phase 1 and Phase 2. For display purposes, the total impacts from the three-year construction period for Phase 2 were divided evenly over years 1, 2, and 3 of that phase. Also included in years 1, 2, and 3 of Phase 2 are the annual operations impacts from Phase 1 that carry through until the Phase 2 operations impacts take effect at year 4 of that phase.

FIGURE 3: Construction and Operations Impacts on Jobs for Phase 1 and Phase 2

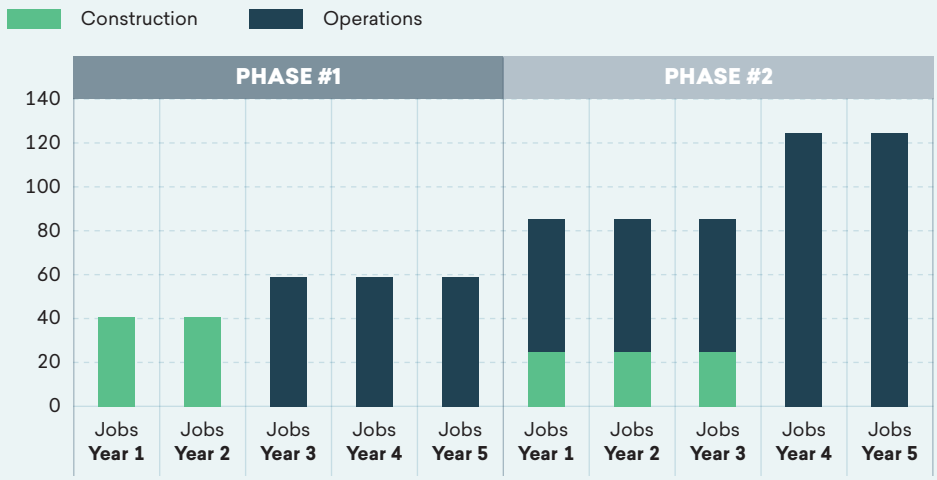
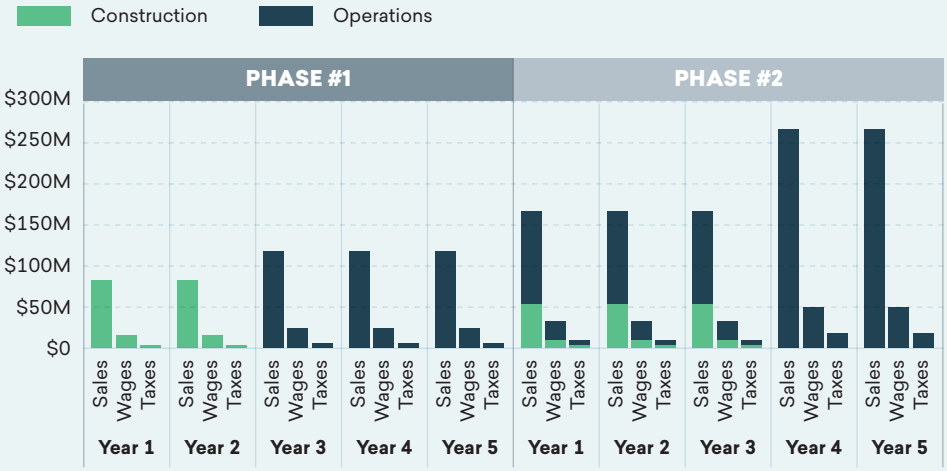


FIGURE 4: Construction and Operations Impacts on Sales, Wages, and Taxes for Phase 1 and Phase 2



PROJECT PHASE 3

After continuing the successful operations of The Floating Island Project throughout Phase 2, it is assumed that even more growth will be needed. This will yet again require the construction of more floating platforms (to create a third group of islands in the sea zone) and the development of even more land to further expand the land zone.

Phase 3: Short-Term Construction Scenario (Temporary Impacts)

For Phase 3 of The Floating Island Project, it is assumed that an additional 10 large floating platforms (25m × 25m) and 5 small floating platforms (14m × 14m) to create a third group of islands that will occupy the sea zone. These islands will include more residential units, work spaces, research facilities, communal spaces, and retail space. It is assumed that the construction workers will have gained even more knowledge and skills during Phase 2 construction, and the expanded infrastructure that is already in place from Phase 1 and Phase 2, will decrease the platform construction costs by an additional 10%, lowering them to $3,000 USD (321,000 XPF) per square meter.

It is also assumed that an additional 10 hectares (24.7 acres) of land will be developed to further expand the land zone during Phase 3. This expanded section of the land zone will include more residential units, expanded support infrastructure, and a resort hotel. It is assumed that the development costs for the Phase 3 land zone expansion will increase by 25% to account for the construction of the resort hotel, raising them to $531 USD (56,817 XPF) per square meter.

It is estimated that the Phase 3 construction scenario will also take three years to complete and will cost $74.8 million USD (8.0 billion XPF). This third large investment into the French Polynesian economy is expected to stimulate a total of $254.9 million USD (27.3 billion XPF) in sales during Phase 3 construction. It is estimated that these new sales will create or support a total of 1,220 jobs, generate $41.3 million USD (4.4 billion XPF) in wages, and produce a total of $14.7 million USD (1.6 billion XPF) in tax revenue for French Polynesia during the three-year construction period. See Table 9 for more details.

TABLE 9: Estimated Economic Impacts Resulting from 3 Years of Construction during Phase 3

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	513	$74.8	$13.5	$88.3	$0.0
Ripple Effects	707	$180.1	$27.7	$207.8	$14.7
Total Impact	1,220	$254.9	$41.3	$296.2	$14.7

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Phase 3: Long-Term Operations Scenario (Annual Impacts)

The operations scenario for Phase 3 also begins at year four, when it is assumed that the additional facilities constructed for the land and sea zones will be fully occupied. As was the case for the Phase 1 and Phase 2 operations scenarios, this scenario does not attempt to quantify preliminary operations impacts as residents and businesses begin occupying the new facilities prior to the completion of Phase 3 construction. However, during the three-year construction period of Phase 3, The Floating Island Project will remain operational, continuing to contribute annually to the French Polynesian economy as previously described.

During Phase 3, it is still assumed that the high-end restaurant will average $70 USD (7,490 XPF) per patron and the boutique lodging facility will have an average nightly rate of $950 USD (101,650 XPF), but for this operations scenario, it is assumed that the high-end restaurant will now fill to 95% of capacity during Phase 3, thus having an annual revenue of $2.4 million USD (260 million XPF).[14] It is now assumed that the boutique lodging facility will also fill to 95% of capacity during Phase 3, thus having an annual revenue to $9.9 million USD (1.1 billion XPF).[15] Also during Phase 3 is the operations of the new resort hotel. It is assumed that this resort will have 40 rooms, an average nightly rate of $700 USD (74,900 XPF), and will fill to 75% of capacity, thus having an annual revenue of $7.7 million USD (820 million XPF.[16]

Together, the high-end restaurant, boutique lodging facility, and resort hotel are estimated to generate $20.0 million USD (2.1 billion XPF) in annual revenue during Phase 3 of The Floating Island

14 100 patrons × $70 USD (7,490 XPF) per patron × 365 days per year × 95% capacity = $2.4 million USD (260 million XPF).
15 30 rooms × $950 USD (101,650 XPF) × 365 days per year × 95% capacity = $9.9 million USD (1.1 billion XPF).
16 40 rooms × $700 USD (74,900 XPF) × 365 days per year × 75% capacity = $7.7 million USD (820 million XPF).

Project. This revenue is expected to stimulate an additional $49.4 million USD (5.3 billion XPF) in sales, bringing their total annual sales impact to $69.4 million USD (7.4 billion XPF). This sales impact will create or support a total of 504 jobs each year, generate $16.0 million USD (1.7 billion XPF) in annual wages, and produce $4.0 million USD (431.1 million XPF) in annual tax revenue for French Polynesia. See Table 10 for more details.

TABLE 10: Estimated Annual Economic Impacts Resulting from Restaurant and Lodging Operations during Phase 3

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	285	$20.0	$7.6	$27.6	$0.1
Ripple Effects	219	$49.4	$8.3	$57.7	$3.9
Total Impact	504	$69.4	$16.0	$85.3	$4.0

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

For this operations scenario, it is assumed that the new facilities constructed during Phase 3 will also house a variety of businesses, across multiple industries. With this new growth, the land sea zones are assumed to now have enough capacity to support 475 workers (jobs) annually. It is assumed that the Phase 3 jobs will still include maintenance, technical and scientific researchers, software development, administrative and clerical, accounting and finance, legal services, transportation, management and operations, real estate, healthcare, and agriculture workers, retail workers will also be included. In total, an estimated 1,672 jobs will be created or supported annually by these initial 475 jobs during Phase 3 (excluding jobs associated with the high-end restaurant, boutique lodging facility, and resort hotel). This will generate $69.5 million USD (7.4 billion XPF) in annual wages, $386.1 million USD (41.3 billion XPF) in annual sales, and $25.4 million USD (2.7 billion XPF) in annual tax revenue for French Polynesia. See Table 11 for more details.

TABLE 11: Estimated Annual Economic Impacts Resulting from Business Operations during Phase 3

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	475	$114.4	$21.3	$135.7	$4.2
Ripple Effects	1,197	$271.8	$48.2	$319.9	$21.1
Total Impact	1,672	$386.1	$69.5	$455.7	$25.4

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Altogether, Phase 3 operations of The Floating Island Project are estimated to create or support a total of 2,175 jobs annually. This will generate $85.5 million USD (9.1 billion XPF) in annual wages, $455.5 million USD (48.7 billion XPF) in annual sales, and $29.4 million USD (3.1 billion XPF) in annual tax revenue for French Polynesia. See Table 12 for more details.

TABLE 12: Estimated Annual Economic Impacts Resulting from All Operations during Phase 3

	JOBS IMPACT	SALES IMPACT million USD	WAGES IMPACT million USD	TOTAL EFFECTS million USD	TAXES IMPACT million USD
Initial Effects	760	$134.4	$29.0	$163.3	$4.3
Ripple Effects	1,416	$321.2	$56.5	$377.7	$25.1
Total Impact	2,175	$455.5	$85.5	$541.0	$29.4

Source: Emsi, custom I-O for French Polynesia, 2017
Note: Values may not sum to total due to rounding

Figures 5 and 6 show the estimated impacts to jobs (Figure 5), and sales, wages, and taxes (Figure 6) from construction and operations during the first five years of all three phases. For display purposes, the total impacts from the three-year construction period for Phase 3 were divided evenly over years 1, 2, and 3 of that phase. Also included in years 1, 2, and 3 of Phase 3 are the annual operations impacts from Phase 2 that carry through until the Phase 3 operations impacts take effect at year 4 of that phase.

FIGURE 5: Construction and Operations Impacts on Jobs for Phase 1, Phase 2, and Phase 3

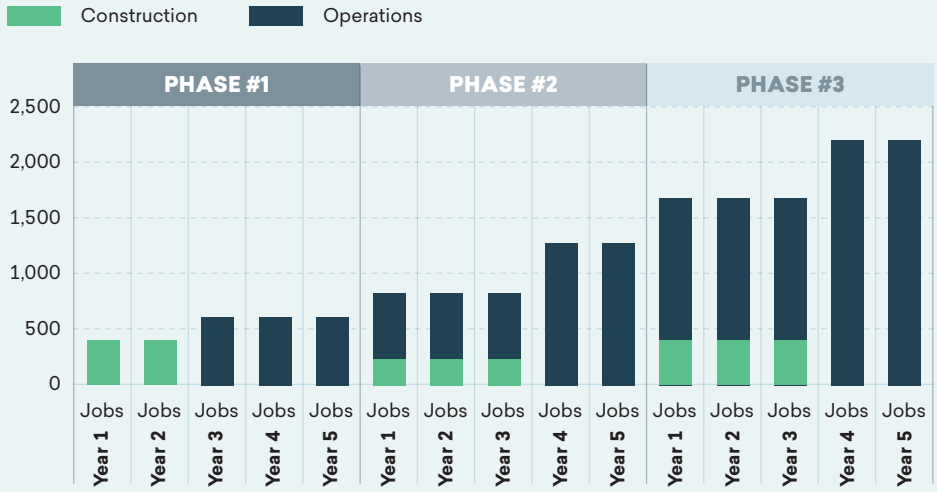
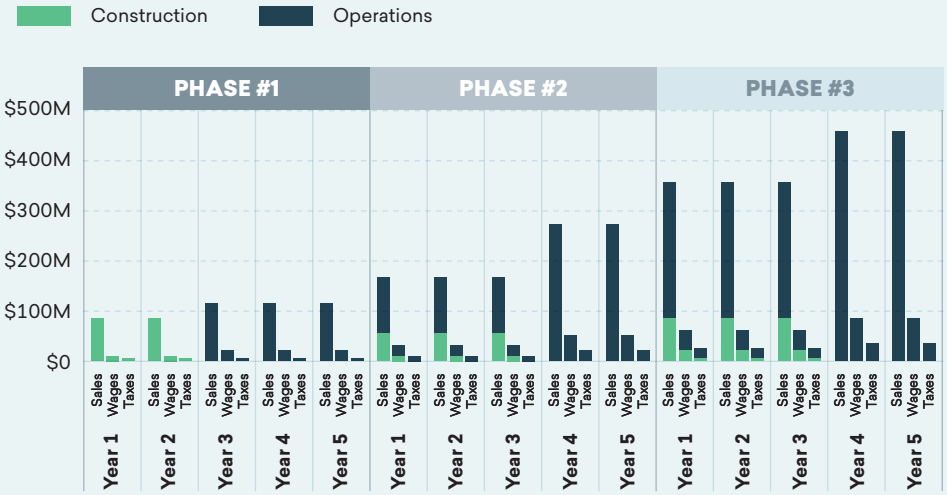


FIGURE 6: Construction and Operations Impacts on Sales, Wages, and Taxes for Phase 1, Phase 2, and Phase 3



Tangential Impacts

BEYOND the typical economic impacts that are estimated in the preceding sections are potential quality of life improvements and employment enhancement opportunities for the citizens of French Polynesia that could result from The Floating Island Project. First, the platforms that will be built to create the islands in the sea zone will include technologically advanced infrastructure to support life at sea. These will include power generation, potable and wastewater treatment, and hydroponic agriculture to name a few. These systems will also be deployable to smaller, more rural islands throughout French Polynesia, helping to reduce environmental impacts, while improving the quality of life for their residents. The jobs to build and maintain these systems will require advanced skills, resulting in training and employment opportunities for French Polynesians, outside of the confines of The Floating Island Project.

Second, The Floating Island Project is expected to attract businesses that will support high-paying jobs. These employers will require advanced skills and education for their employees that offers the potential for additional training opportunities for residents of French Polynesia. Further, these new job opportunities will likely encourage some French Polynesian youth to stay in the country and encourage French Polynesian expatriates to return home.

Third, many of the business activities resulting from the operation of The Floating Island Project will result in heavy Internet usage – the downloading and uploading of vast amounts of data. It is estimated that this increased Internet usage will drive down the overall cost of Internet service for all of French Polynesia over time.[17]

Lastly, The Floating Island Project has generated a lot of media attention. Over 100 articles have been written about the project to date from news media, including the Wall Street Journal, the New York Times, the BBC and Reason Magazine, and it is anticipated that the media attention will only grow as the project enters the pilot phase. Based on experiences of other tourism locales, it is estimated that for every one thousand (1,000) favorable media impressions across the globe, an additional $75,000 USD (8.0 million XPF) in tourist spending will be generated in the economy being highlighted.[18] In addition to a potential increase in tourism spending, all the media attention about The Floating Island Project, in particular the SEZ, could also have a positive impact on foreign investment or attract additional new businesses to French Polynesia.

17 "Journal officiel de la Polynésie française": http://lexpol.cloud.pf/LexpolAfficheTexte.php?texte=478773"

18 Goss, L. E., Ph.D. (2007, February 14). Measuring Travel and Tourism PR. Retrieved from http://painepublishing.com/wp-content/uploads/2013/10/PainePublishing3RealLifeExamplesOfHow.pdf

Appendix A: Methodology

For this project, Emsi created a custom I-O model to understand the flow of money in the French Polynesian economy.

An input-output model is a way of representing the flow of money in an economy, primarily among industries, while also accounting for government, households, and regional imports and exports. Once the flow is represented in the model, a user can introduce events that change the flow (such as loss or gain of jobs/sales in one industry) and simulate its effects on each industry in the region, as well as the region as a whole. These events are the scenarios that are to be modeled to understand their economic impacts. Economic impact results are shown for estimated changes in the number of jobs, sales revenues, earnings, and taxes.

This complex web of transactions (the flow of money referred to above can be arranged according to a particular accounting system called "input-output accounts." They are called "input-output" because a portion of the output (i.e., sales) of one industry will appear as the input (i.e., purchases) of other industries. These accounts track the flow of money from one entity to the next, and from them we can get a sense of the interconnectedness of the industries, households, and government entities. The accounts are used to build to I-O model to simulate and display these relationships. The input-output model therefore indicates how a change in one part of the economy will ultimately affect other parts based on these purchasing and selling relationships.

This I-O model allows us to demonstrate how the initial investment of construction and development of the land zone and sea zone, and how the ongoing operations of businesses that will locate in the SEZ, will support or create additional jobs, add labor income, add sales, and generate taxes within the French Polynesian economy. The custom I-O model also accounts for leakages out of the French Polynesian economy in the form of imports: purchases of goods and services from other countries. Because imports represent a substantial portion of the French Polynesian economy, these leakages must be considered to better estimate the potential impacts of The Floating Island Project.

To build the custom I-O model for French Polynesia, Emsi started with the "tableaux des ressources et des emplois" (TRE) (tables of resources and jobs), a dataset produced by the Institut de la statistique de la Polynésie française (iSPF) (Institute of Statistics of French Polynesia). The tables from the TRE provide a summary of how industries produce and consume commodities at the national level, showing which industries produce and consume which commodities (including services), and how much. The data from the TRE tables was used to create an inter-industry sales and use matrix.

The matrix shows rows and columns – each column being the use of goods or services that a particular industry purchases from other industries. Each row shows all the sales of a particular industry to all the other industries. Following standard practice, Emsi's model uses a square matrix, balanced so each row sum exactly equals the corresponding column sum. Each cell of the matrix

shows the flow of money at the national level between the sectors represented by the row and column headers.

The following is a high-level list of the sectors represented by the rows and columns of the national matrix and the relationships between them:

- **Industry Accounts:** the activity of the domestic industries
- **Labor Accounts:** the earnings and expenditures of workers in certain careers
- **Tax accounts:** purchases of government services from taxes on production and imports
- **Investment accounts:** captures the source and spending of funds for current investments in the region.
- **Trade Balance Account:** the account added to the matrix to handle the international trade imbalance or difference between imports and exports
- **External Account:** the exports of all sectors from the region

Once this matrix was created, it was balanced so that inputs and outputs were aligned. From this balanced matrix, I-O coefficients were calculated. These coefficients allow for the calculation of sales multipliers for each industry sector in the French Polynesian economy.

The Emsi I-O model for French Polynesia uses three types of multipliers: sales, jobs, and earnings. A multiplier is a number showing how changes (jobs, earnings, or sales) in one industry will propagate to other industries in a regional economy. For example, a jobs multiplier of 3 means that a change of 100 jobs in that industry would lead to a total change of 300 jobs (3 × 100 = 300) in the whole economy. Note that this 300 includes the original 100 jobs, meaning the additional change is 200. In the study of IO, the original jobs are called the "direct" effect, while the additional jobs are called "indirect" effects.

Next, we converted the sales multipliers into jobs and earnings multipliers to allow us to calculate the direct and indirect effects of introducing new jobs and wages into the French Polynesian economy. We did this by using jobs-to-sales ratios and wages-to-sales ratios derived from the TRE. The TRE also provides a distribution for taxes and ratios of spending across industry sectors to illuminate consumer spending patterns. The tax distribution is used by the I-O model to calculate tax impacts of added sales activity. Likewise, the consumer spending ratios are applied to changes in labor income[19] to calculate final increases in sales across all industry sectors.

Multipliers are key component of how the I-O model measures the impact of a scenario. As mentioned earlier, Emsi uses earnings multipliers when measuring the impact of an industry; however, jobs multipliers are put to use as well. Jobs multipliers are determined using the same methodology as for calculating earnings multipliers. Jobs multipliers are prone to be inflated or deflated when applied to specific scenarios. For example, for any given scenario, if the project/company/industry being modeled employs a large number of people and pays more than average wages for that industry, the workers' spending, because of higher than assumed wages, will have greater

19 For more info see: http://www.investopedia.com/terms/c/consumer-spending.asp

impact in reality than what the modeled results estimate. Conversely, if people purchase more goods and services from outside of the region than what is assumed in the model, the impact of their spending will, in reality, create fewer local jobs than the model will estimate. Therefore, when modeling a given scenario, the jobs multiplier is modified by the earnings multiplier using actual expected earnings for the scenario. The earnings multiplier estimates the fiscal impact for a scenario. These fiscal estimates are then used to modify the jobs results to more accurately estimate the impacts of a modeled scenario.

In summary, the data obtained from the TRE is essentially an accounting system that tracks the many economic interactions between residents, industry, and government. In particular, a matrix is created that shows the purchases and sales between industries; the matrix provides the basis for the model to estimate the impacts of changes in any one industry on other industries and other segments of the economy. As one dollar goes to one industry, portions of it are passed off to other local industries and another portion "leaks out" of the region completely (usually in the form of imported goods or services). Then we look at all the other industries that got a piece of the original dollar and look at how much of those pieces go to other regional industries or leak out because of imports. We continue this indefinitely until the portion of the original dollar still remaining in the region approaches zero. At each step, we sum up the amount that stayed in the region during that step. The grand total (plus the original dollar) is the final multiplier.

Appendix B: About Emsi

Emsi

Economic Modeling Specialists International (Emsi) is based in Moscow, Idaho, and was founded in 2001 by Drs. Kjell Christophersen and Hank Robison as a company designed to study the economic contribution of higher education and workforce development. Over the years, Emsi has evolved into a professional services firm, specializing in advanced economic impact modeling, economic research, and labor market data analysis. With a team of close to 125 employees, Emsi provides custom analyses, reports, training, web-based tools, and unparalleled labor market data to more than 500 organizations in the US, Canada, and the UK. To date, Emsi has conducted more than 1,700 comprehensive, regional economic impact studies. In August 2012, Emsi was purchased by CareerBuilder.