

Developing a Software Industry with TSP and PSP

Carlos Montes de Oca, PhD

**Center for Mathematical Research
CIMAT**

Introduction

- There is a national initiative in Mexico to promote the software industry
- Two major initiatives use TSP and PSP
- These initiatives have to deal with strategies for large-scale introduction of the PSP and the TSP to both, industry and academic organizations
- Major initiatives
 - One is lead by ITESM, a private university in Mexico, with the support of the Nuevo León State
 - The other is lead by the government of the Zacatecas State
 - A third one in the Guanajuato State

Presentation Objective

Describe the strategic model, current status, challenges and future direction of the Zacatecas initiative

Agenda

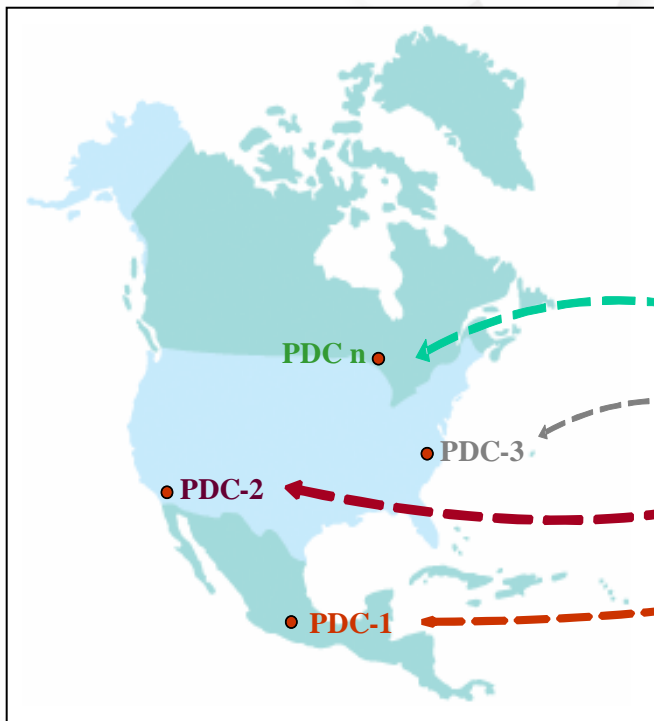
Background
Strategic Model
PSP and TSP Strategies
Current Status and Early Results
Challenges and Lessons Learned
Future Work

Background

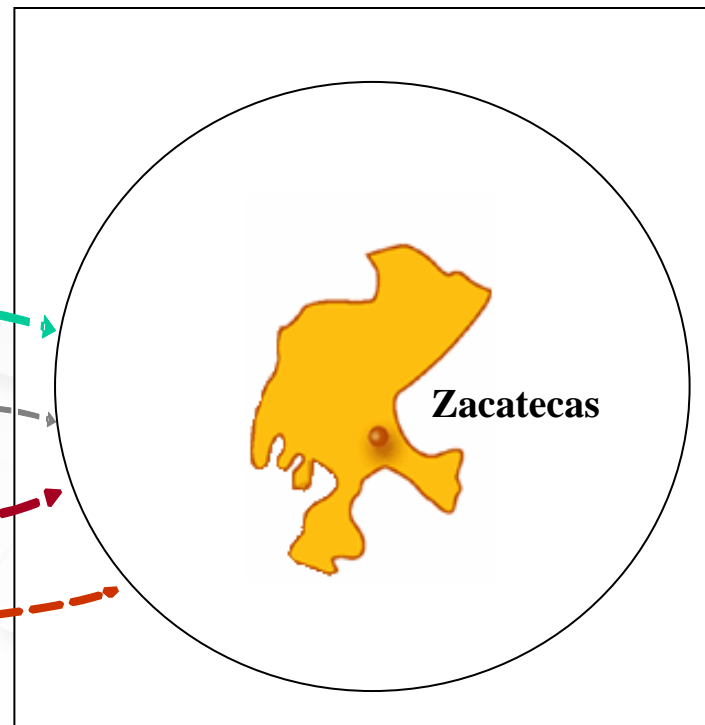
- The Zacatecas State
 - Semi-desert, no natural resources, water shortage
 - Limited industry
 - High emigration to the US
 - Need for new economic alternatives
- The origins of the project
 - The Governor became interested in the IT industry
 - Governor leadership to develop the IT industry
 - Alignment of interests and strengths:
 - Government: Governor, Secretary of Economic Development, Secretary of Education
 - Industry: QuarkSoft
 - Academics: CIMAT
- Goal: Make Zacatecas an IT leader
 - Retain Zacatecas workforce / create job opportunities
 - Attract software/IT companies to locate in Zacatecas
 - Export software/services to the US and Europe
 - Leverage government support to accomplish these goals

Initial Business Model

Proximity Development Centers PDC



Global Delivery Centers GDC



Goals:

- Reduce development costs
- Ensure reliable service levels (quality, schedule)

Target effort distribution
PDC 30% / GDC 70%

Initial Strategic Model

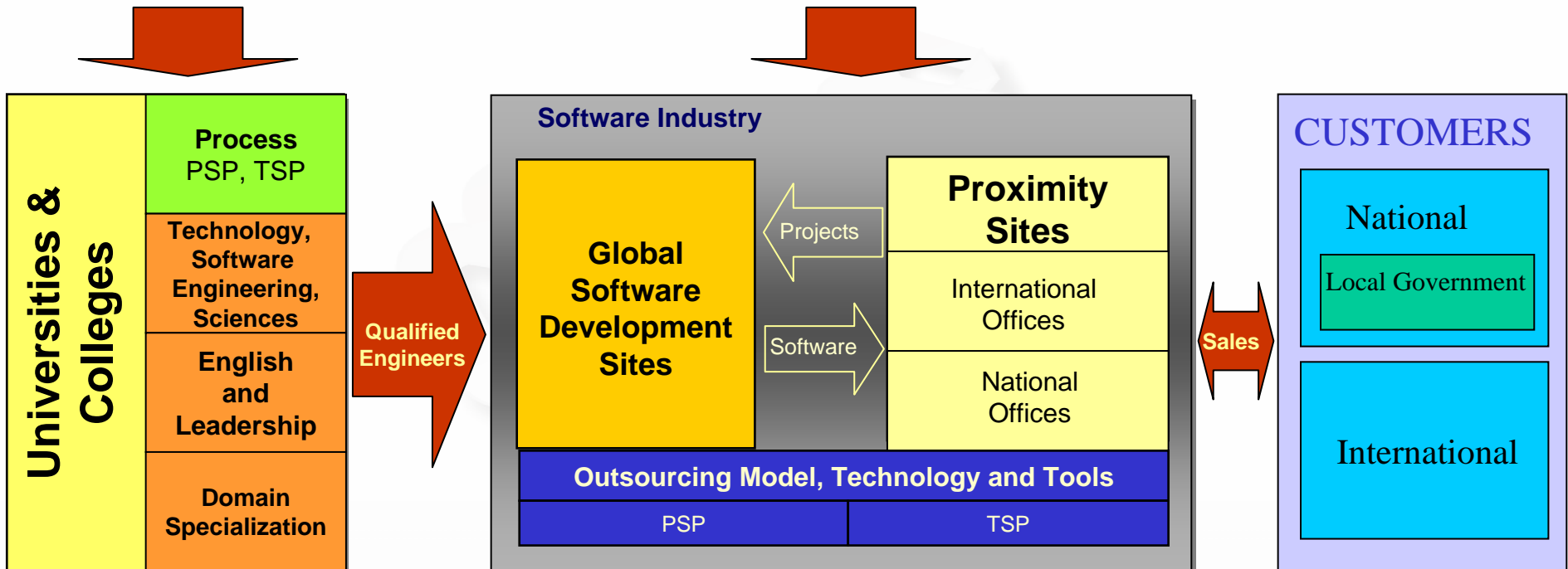
Project Board

IT Institute

Academics (Grad School & Continuous Education)

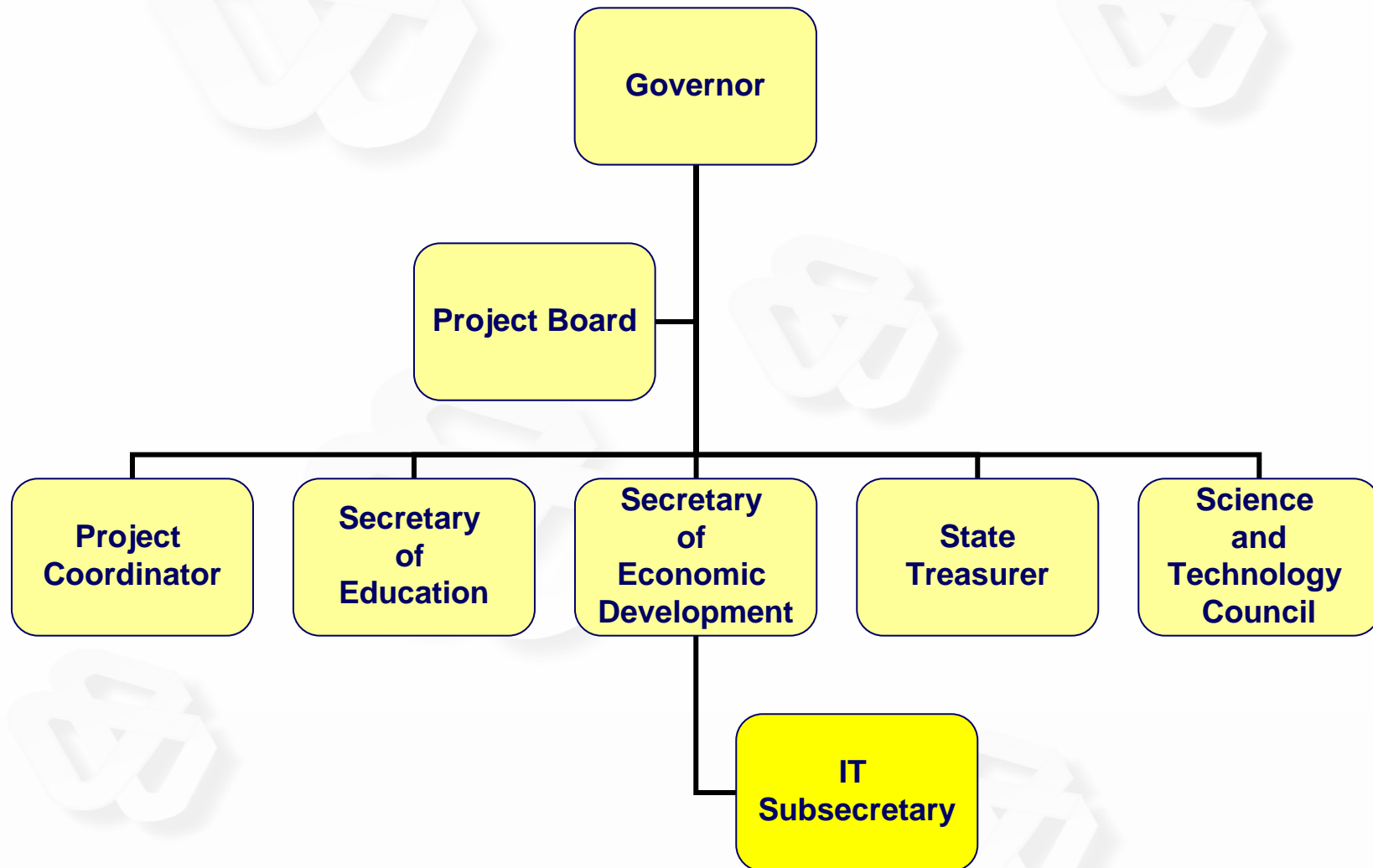
Technology Transfer

R&D



Marketing and Investment Attraction

Project Organization



Strategy

1. Invest on producing good and enough software engineers
 1. Improve Software Engineering education state wide
 2. Use PSP and TSP as foundation
 3. Create the IT Institute
 4. Improve English and leadership
2. Pilot the model. Produce a success story
3. Attract companies by offering the best possible engineers and a proven model
4. Foster new companies / spin-offs
5. Invest in infrastructure: High-tech park
6. Diversify the industry: telcom, BPO,

Industry

- Piloting the strategic model
 - Quarksoft is the company used for the pilot
 - 6 year experience with PSP and TSP
 - Evaluated CMMI L3
- Promote that other companies:
 - hire engineers graduated from local universities
 - use TSP and PSP
- Attract software companies
- Form a cluster of software companies

Customers

- National
 - Local Government
 - Outsourcing for companies in larger cities
- International
 - US market
 - Europe market
- Need to find customers who shop quality instead of low cost

Academic part

- 11 universities/colleges are participating
- Adapting their curriculum to include
 - PSP and TSP education
 - Software Engineering courses
 - Improved programming courses
 - Math and statistics courses
 - Internships
- Faculty training
- Aggressive plan to improve English proficiency

ITI

- Information Technology Institute
 - Scientific arm of the project
 - Support for both universities and industry
 - Initially funded by federal and local government
- Mission
 - To produce, transition and apply IT technology to foster economic development
- Strategic Objectives
 - Produce new knowledge and technology to promote the development of the industry and the academia
 - Produce highly qualified faculty and professionals
 - Transition knowledge and technology to both the industry and the academia
 - Promote the IT profession

Curriculum

- 7 universities involved (First stage)
- Two academic Programs
 - Computer systems engineer
 - Informatics
- Proposed changes
 - 8 New courses
 - 11 Modified courses
 - Internships reorientation

New Courses:

1. PSP
2. OO Analysis and Design
3. SE Fundamentals
4. Models for SW development
5. Professionalism Seminar
6. Global SW development
7. SW Architecture
8. Software V&V

Modified Courses:

1. Programming Fundamentals
2. OO Programming
3. Selected Topics on Programming
4. WEB Programming
5. SW Systems Fundamentals
6. Planning and Modeling
7. Software Development Projects
8. Math I to Math IV

PSP Strategy

- Faculty training
 - SEI-Partner delivered PSP for Engineers I & 2
 - 2 weeks full time format
 - Faculty ranking: Principal / Associate
 - Faculty become SEI-Certified PSP Developer
- Materials
 - Develop materials in Spanish vs using SEI academic materials
 - Get books for the libraries
- Initial deployment
 - A faculty ranked as “principal” leads the course
 - 1 instructor/associate to grade assignments up to 10 students (Difficult to get !!)
 - One (two?) semesters
 - 10 programs, 5 reports
- Support
 - Workshop to set up a college-level PSP course
 - On-site visits for follow up activities
- Annual PSP/TSP Education Symposium
- Each participating university offers a PSP course at least once a year
- Create a PSP steering committee to develop a state-wide PSP educational system
- Promote the use of PSP principles in other courses

Workshop

- 3-day workshop for faculty who is scheduled to teach PSP in college
- Main topics
 - Problems in SE education
 - Considerations and Models for education in Software Engineering
 - Analysis of course requirements and location of the PSP course in the curriculum
 - Strategies for developing and using course materials and tools
 - Standard syllabus and map of activities for a PSP course
 - Strategy to develop the course plan
 - Assignment review exercises and review tips
 - Course tips and grading tips (EV-based grading)
 - Develop a PSP faculty community

TSP Strategy

- PSP-trained faculty participate in a TSP team for a small project
 - to gain first-hand TSP experience
 - Projects for real companies
 - MSE-Directed to faculty
- Develop Coach capabilities in faculty who participated in a TSP team
- Faculty lead TSP teams
 - Faculty with coach capabilities coach TSPi teams of PSP-trained students and/or PSP-trained students (and faculty) participate in real-world TSP teams during their internships (in companies using TSP)

Guanajuato Project

- **Background**
 - State initiative lead by the state Science and Technology Council
 - 16 universities involved
 - Marginal Industry involvement
- **Strategy**
 - Create a cluster of universities to develop and test software
 - Produce high-qualified students
 - Introduce PSP and TSP into the curriculum and for the cluster operation
- **Early results**
 - 44 faculty trained in PSP (PSP for Engineers I & 2)
 - 13 faculty passed the SEI-PSP Certified Developer Exam

Early results

- PSP transition to 12 universities in Zacatecas
- 46 faculty have taken the PSP for engineers course
- 23 faculty passed the SEI-Certified PSP developer exam
- More than 150 students took a PSP course during fall 2006
- 5 out of 7 students passed the SEI-Certified PSP Developer exam
- More than 100 students took PSP on spring 2007
- First symposium on PSP education (Feb. 2007)
 - Watts gave the Keynote
 - 12 presentations
 - 1 open-discussion panel

Early Results

- The curriculum of 7 colleges/universities has been updated to:
 - Include PSP-TSP
 - Include 6 Software Engineering courses
 - Improve Programming skills
 - Include a course in soft skills
 - Improve 4 math courses
 - Plan to train faculty in these new and updated courses
- Additional Faculty training
 - OO Analysis and Design (26 faculty)
 - Requirements (24 faculty)
 - Advance OO Programming (30 faculty)
- Industry adoption
 - 1 small company is using PSP and looking for funding to adopt TSP
 - Quarksoft continue to train new hires in PSP and TSP
 - Large mexican software companies interested in the project

Lessons Learned

(PSP symposium conclusions)

- Introducing PSP in universities:
 - requires changing the education system from the root
 - Requires changes in the educational management system
 - Need support from upper university management
- Decide on one vs two semester PSP course depends on many factors
- There is no agreement if 8 or 10 programs are necessary
- Critical requirements: math, programming skills, English
- Critical soft factors: discipline and tolerance to frustration
- Assignment feedback must be detailed and fast (this is difficult to achieve)

Lessons Learned

(PSP symposium conclusions)

- A good practice is to review the assignment with the student
- Teaching PSP in earlier semesters did not work well. Better for junior and senior students
- A full 10-program PSP course is difficult to implement
 - Faculty assignment review workload
 - Student workload
 - It was difficult for a student to get to program 8
 - It is recommended a 2-semester course for PSP
- Program and data plagiarism has not been detected; but Risk is there
- Difficult to convince universities to include PSP and TSP courses
 - These courses require “special” treatment
 - It implies changing some university policies
 - E.g., reduce the workload of faculty or increase course credits.

Challenges and Lessons Learned

- Key factors for teaching PSP to faculty and students
 - Faculty selection
 - Student selection
 - Course requirements
- Need to improve
 - Faculty selection and training
 - Student's technical and soft skills
 - English proficiency for both faculty and students
 - Books, BoK, course materials
 - PSP/TSP Course materials
- Faculty and students need to practice PSP
- Transition TSP to universities is a major effort
 - Form coaches
 - Adapt curriculum
 - Grading
 - Logistics to set up real-world projects: people, tools, site, the project..
 - Internships seems to be a good option

Challenges

- Keep alive the PSP Education Symposium
- Improve math education
- Re-engineer the state education system
- Get more faculty
- Improve faculty skills/real-world experience
- Attracting companies willing to use TSP
- Quality assurance

What is ahead?

- Keep the project alive!
- Next steps in transitioning PSP and TSP
- Create State Board of PSP Education
- Create the IT Institute
- Continue faculty training
- Promote certifications: PSP and others
- Offer the Master in Software Engineering program to faculty and practitioners
- Attract more students to IT
- Show that the strategy works

Summary

- Aggressive strategy to create and promote a software industry
- Government, Industry and Academia working together
- Governor full support
- “Long-term” project
- Targeting US and EU markets
- Developing good and enough software engineers as a key strategy component
 - PSP/TSP as a foundation
 - Massive deployment of PSP and TSP

Carlos Montes de Oca, PhD

moca@cimat.mx

www.cimat.mx/~moca

Center for Mathematical Research (CIMAT)

Jalisco S/N Mineral de Valenciana

Guanajuato, Gto, 36000 Mexico