Arizona Partnership for Housing Innovation

Anil Sawhney[1]

Abstrract

Production homebuilding in the US still uses many technologies and materials employed generations ago. Methods for the identification, testing, and deployment of new technologies and materials do not exist in any cohesive form. This paper presents a measured and reasonable response, which seeks to create a regional partnership to "imprint" an innovation culture on the Arizona homebuilding industry. The partnership, termed AzPath, is an innovation enterprise dedicated to bringing innovation to the housing industry in Arizona, and a model for deployment of similar enterprises across the nation. Arizona State University has entered into partnership with Partnership for Advancing Technology in Housing (PATH), five major homebuilders, and the Home Builders Association of Central Arizona. This position paper provides insights into accomplishing improvements in the homebuilding industry through a partnership between industry, government and academia.

Keywords: Homebuilding Production, Partnership for Advancing Technology in Housing (PATH), Homebuilding industry

Introduction

Satisfying the basic human need of shelter has always been one of humankind's principal activities. As such, in the United States, the homebuilding industry has developed into a significant employer, cash generator, and contributor to the economy. Homebuilding employs more than 3.5 million workers each year and housing investment and consumption contribute one-fifth of the US gross domestic product (Joint Center for Housing Studies 1997). Also, with so many homes being built, the US housing stock has developed into the nation's largest single assets with a total value that exceeds that of the US equity markets.

However, despite the significant importance of housing, the US homebuilding industry is still the "industry that missed the industrial revolution." Homes are still built using many of the technologies, features, and materials employed many generations ago. This is not due to a complete lack of innovation but rather due to the lack of a clear-cut driver of innovation.

In recognition of the central role played by homebuilding and other construction activities in the US economy and that a healthy, efficient, and technologically advanced homebuilding industry can contribute to a strong role in international trade and a vigorous domestic market, the federal government set forth a set of seven National Construction Goals in early 1994 (NAHBRC 1998).

[1] Associate Professor, Del E. Webb School of Construction, Arizona State University, Arizona, USA, Email: anil.sawhney@asu.edu

Problem Statement

With the establishment of PATH, the federal government in the US has taken a bold leadership step to provide an industry-wide focus on housing technology innovation. However, the housing industry is so large and complex that introducing change is very difficult. Only regional "clusters", alliances, and partnerships between homebuilders, building specialists, manufacturers, suppliers, institutions (both academic as well as research), and governmental agencies have a prospect of succeeding to create an atmosphere that will nurture innovation. The operational effectiveness of the national initiatives such as PATH can be guaranteed by launching regional partnerships such as AzPath, which is presented in this paper.

Arizona Partnership for Housing Innovation--AzPath Overview

AzPath is an enterprise dedicated to bringing innovation to the housing industry in Arizona and the desert southwest and a model for deployment of similar enterprises all across the nation. Arizona State University (ASU) has entered into partnership with PATH, five major homebuilders, and the Home Builders Association of Central Arizona (HBACA). Expansion beyond these core partners will occur as the partnership develops to reach out to key stakeholders, technology developers, building specialists, community groups, and others whose participation will be needed. The core partners are active partners in a structured program, which drives a continuous cycle of adoption of new technology in the industry. All partners participate in the identification of critical areas of improvement. The university and the core partners will work together to identify potential technologies, which can address these critical areas. All stakeholders to the deployment of these technologies have been brought together to develop a prototyping program, and to monitor and improve the deployment process. For every deployment, prototyping on a few homes will be systematically conducted and measured, and developed to the point that mass implementation and adoption is possible. At this point, the cycle can begin again for other critical areas and new technologies.

AzPath Goal and Objectives

The goal of AzPath is to serve as a catalyst for continuous innovation in the housing industry in Arizona through strong partnerships with national and regional organizations. The short-term objective of AzPath is to build a "culture and infrastructure" that will promote innovation in the housing sector in the long-term.

Organization and Management of the AzPath Partnership

AzPath's regional partnership is led by ASU and consists of seven core partners and seven additional consulting partners. The core partners form the operational portion of the partnership, while the consulting partners are available to assist the core partners on a request basis. The core partners were carefully selected for their interest and commitment to quickly create an innovation enterprise. The consulting partners were selected for their expertise and linkages with important groups. Figure 1 shows the organizational structure of AzPath.

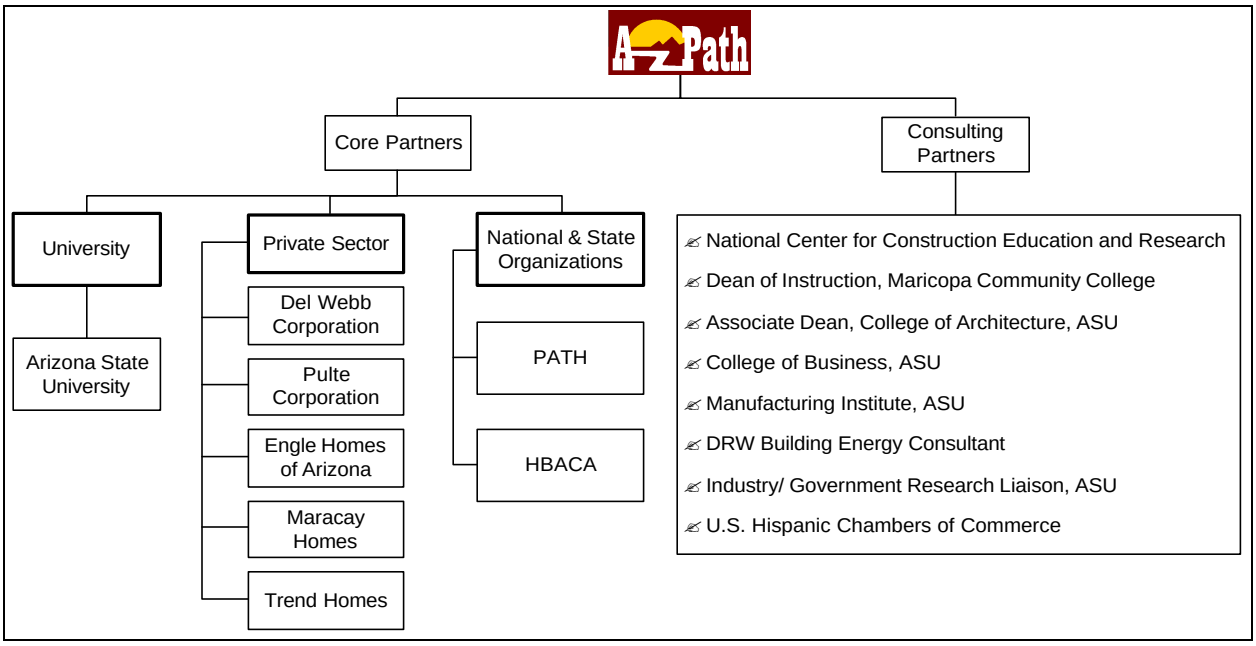

Figure 1. The organizational structure of AzPath

AzPath Innovation Model

AzPath accomplishes its goal and objectives through research and development efforts that are focused upon a "Plan Do Study Act" model that is contained within the seven steps described below. To be truly effective these steps in fact run in a continuous (innovation-) cycle. Figure 2 shows the innovation model that has been implemented by AzPath. The seven steps of the innovation model are:

1) The core partners form a cohesive team, which identifies challenges faced by homebuilders where innovative technologies hold promise of significant improvement to the outcome of the homebuilding process. This step initiates a benchmarking process or a baseline study needed to document the current status of the homebuilding process.
2) ASU in collaboration with core partners identify and evaluate innovative technologies with promise to improve the areas identified in step 1.
3) As the innovative technologies are selected, the partnership is expanded to include key stakeholders who must be included in the innovation process. The new knowledge in form of innovative products, processes, and materials is studied by a focus group to identify test sites and to develop a research and testing program.
4) The improvements, based on the innovative technologies from step 2, are studied and analyzed using process modeling, simulation, or other analysis tools. Plans and/or resources for the development of prototypes using these innovative technologies are developed or identified. Individual partners or a group of partners with other stakeholders (e.g. relevant trade contractors and/or product manufacturers) form “dynamic” teams to develop plans to adopt the innovative technologies in practice at a prototype scale.
5) The prototypes are evaluated, and production optimization studies are performed. Work processes are modified as necessary to realize the full potential of the innovations. On-site

research and development is then undertaken at the test site. Through the active involvement of core partners, consulting partners, and stakeholders in the research and development the ownership and complete understanding are ensured.

6) Through a joint effort, development of large-scale implementation strategies for production level deployment of the innovation/technology including widespread dissemination of the results.
7) Continuous reevaluation and modification the homebuilding process as new innovative technologies are developed/identified.

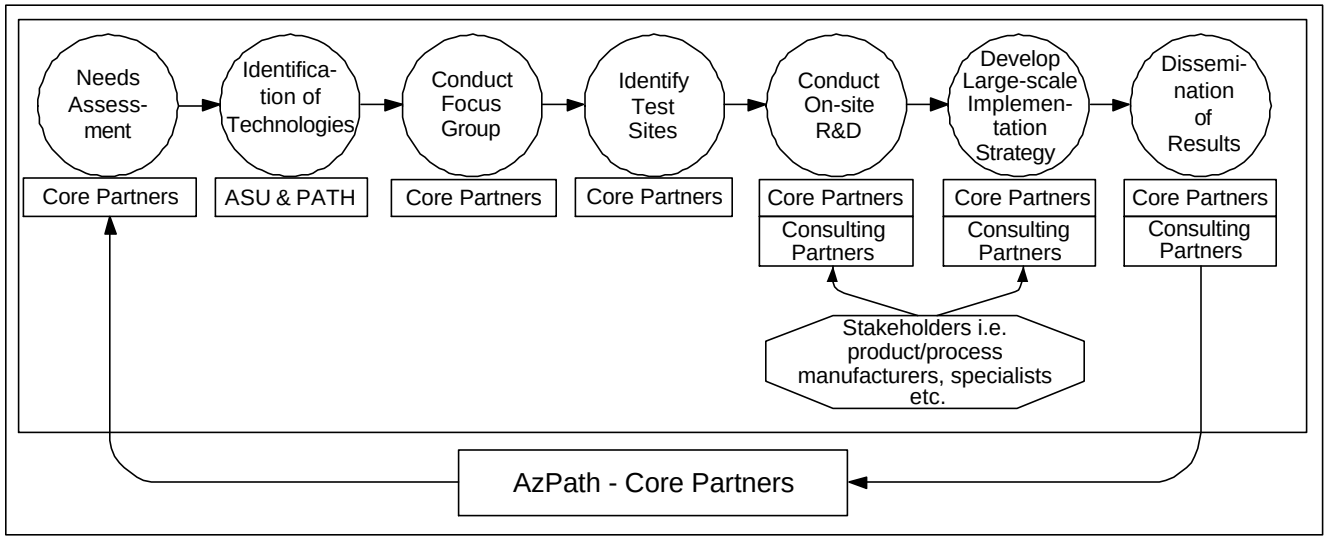

Figure 2. The AzPath innovation model

The implementation of AzPath constitutes a significant break from the traditional role of the university in the research and development process. In order to realize the goal and objectives laid forward by AzPath, a new innovation model that enables technological innovation through synergistic development, integration, and transfer of new knowledge is implemented. AzPath's core partners are proactively involved in the innovation process. The innovation model is envisioned as a continuous process with a feedback loop to the core partners, and continuous identification of new issues.

AzPath's Activities

AzPath is developing a number of other activities to complement and support its generation and transformation of new knowledge.

Identification, Generation, and Transformation of New Knowledge

All core partners are jointly undertaking identification, generation, and transformation of new knowledge. Essentially this activity is the implementation of the innovation model described above.

Small-scale Exploratory Research

In order to test the innovation model proposed, a small-scale exploratory research project is being undertaken. This "high-risk high-reward" research project focuses on the implementation of

innovative cycle-time reduction techniques in the residential construction process. This will serve to solidify the productive links between the AzPath partners.

Integrate Research & Education

One of the thrusts of AzPath is to integrate the research and education effort in order to assure the availability of a workforce ready to embrace innovation in the housing industry. AzPath involves students in the research and educational efforts. Students participating in AzPath interact with employees of the core partners in an environment that is conducive to research and development.

Expand and Sustain the Partnership

Efforts are underway to sustain and expand the AzPath partnership. Based on the first two-year performance, additional builders, manufacturers, and specialists/trade contractors are being asked to join the partnership.

Outcomes of AzPath's Innovation

Implementation of AzPath will bring an innovation enterprise to the homebuilding industry, which has not historically embraced innovation or change. Construction of homes using innovative technologies will result in direct benefits such as reduced cost, increased productivity, increased energy efficiencies, increased quality and durability, opportunities for new businesses, and increased worker health and safety. It should be noted that innovation is the ultimate goal of AzPath as this holds the promise of more significant improvement when compared to simple optimization. Initial projects that are currently underway include the following:

- ?? Benchmarking time and cost of current industry practices
- ?? Identification of key coordination issues between tightly coupled trade contractors
- ?? Utilizing global positioning system technology (GPS) to improve the coordination between tightly coupled trade contractors
- ?? Implementation of information technology to improve coordination between tightly coupled trade contractors
- ?? Comparing the effectiveness of critical chain to critical path project management tools
- ?? Implementation of lean thinking concepts to trade contractor operations
- ?? Identification of barriers to the use of industrial processes for housing manufacture
- ?? Application of supply chain management principles to develop strategic purchasing decisions
- ?? Benchmarking current legal issues related to construction defects litigation
- ?? Mapping land development regulatory processes implemented by the cities and counties in the Phoenix metropolitan area

Conclusions

AzPath is an innovation enterprise that, through the creation of a regional innovation partnership between ASU, PATH, five major homebuilders, and the HBACA, seeks to "imprint" an innovation culture on the Arizona homebuilding industry. Implementation of AzPath will bring an innovation enterprise to the homebuilding industry, which has not historically embraced innovation or change. Simultaneously, the

implementation of AzPath has the potential to significantly improve the energy-efficiency, quality and durability, maintainability, and the health and safety of new housing. This is clearly in line with the national PATH program objectives and ultimately with the Residential National Construction Goals.

PATH and to some extent AzPath represent efforts that seek to create synergy between industry, government and academia for the purpose of diffusion of innovation. Such efforts are not unique to the homebuilding industry. Marked success of this approach can easily be seen in other sectors of the economy. Beginning with the successes in the agriculture, such partnerships have been successfully deployed in the semiconductor manufacturing and automobile manufacturing sectors. For example, Sematech was conceived in 1986 to strengthen the U.S. semiconductor industry. A study of these types of initiatives in other sectors of the US economy will provide a great deal of benefit to the US homebuilding industry.

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References

Joint Center for Housing Studies (1997), *The State of the Nation's Housing: 1997*, Joint Center for Housing Studies of Harvard University, Cambridge, MA, USA, [Online: 01/30/01], http://www.gsd.harvard.edu/jcenter/Publications/State%20of%20the%20Nation%27s%20Housing%201997/page6.

NAHB. (2001), *Economic & Housing Data: Housing & Interest Rate Forecast*, National Association of Home Builders, Washington, D.C., USA, [Online 01/29/2001], http://www.nahb.org/facts/forecast/h ousingandinterestforecast.html.

NAHBRC. (1998), *Building Better Homes At Lower Costs: The Industry Implementation Plan for the Residential National Construction Goals*, National Association of Home Builders Research Center, Inc., Upper Marlboro, MD, USA.

PATH (1999), *PATH Goals and How They are Being Met*, Partnership for Advancing Technology in Housing, Washington, D.C., USA, http://www. pa thnet.org/hip/tech.html.

PATH (2000), *Working Groups*, Partnership for Advancing Technology in Housing, Washington, D.C., USA, [Online 12/11/2000], http://www.path net.org /wrkgrp/login.asp.

PATH (2001), *About PATH*, Partnership for Advancing Technology in Housing, Washington, D.C., USA, [Online 01/29/2001], http://www.pathnet.org/abou t/about.html.