Competency-based dual education: An alliance between industry, education and public sectors to fulfill industry demand and needs of youth in the US – A project success story[1]

Dr. Thomas Baumann[a], Sarah Harfst[b], Amy Cell[c], John Dunn[d]

[a]*General Manager, Orbitak International LLC, Troy, Michigan, USA*
[b]*Consultant, Orbitak International LLC, Troy, Michigan, USA*
[c]*Senior Vice President, Talent Enhancement, Michigan Economic Development Corporation, Lansing, Michigan, USA*
[d]*President, Brose North America, Inc., Auburn Hills, Michigan, USA*

Abstract

The future of industry, and its ability to globally compete, is contingent on the competencies and motivation of its employees. Therefore, competence-based education and youth development are needed to maintain a talent pipeline of employees who have the skills and competencies necessary for industry to succeed in the global market. Such an undertaking requires a professional combination of political vision, academic abilities and acumen, and strong industry involvement, as well as a unified mindset of social responsibility.

Over the last two decades, there has been an increasing skill gap between industry demand and the qualified existing workforce. In Michigan, the state government, industry and educators initiated and implemented- within 12 months- a statewide competency-based dual education system in order to create a competent, readily employable workforce. Using industry defined competencies, nationally recognized academic credentials, and a unique combination of theory, practical instruction and work assignment, Michigan Advanced Technician Training [MAT^2] allows companies to "grow their own" employees, offers graduates viable career options, and ensures the recognition of Michigan as an education innovator and global competitor.

Strong program management with a clearly defined structure [organization, scope, timing, risks, costs…] was crucial in order to ensure the critical balance of different stakeholder interests, the creation of industry-approved competence-based learning content, and the successful completion of program targets. This article will explain the program management approach, complex structure, and ambitious goals of MAT^2, as well as identify the key success [program management] features which will allow it to grow.

Keywords: program management, stakeholder management, PM in education, partner ship,

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1. Introduction

Michigan's 2013 Economic Summit focused on the growing skills gap, and the current disconnect between industry demand and the state's ability to meet both current and future talent needs. Governor Rick Snyder addressed the scope and impact of Michigan's current skill gap, acknowledging that "it's a national issue… not a just a Michigan issue" and there is "no good system to aggregate that demand" [Gallagher, J., 2013]. Skills gap studies across the country indicate that 67% of manufacturers are currently experiencing "a moderate to severe shortage of available, qualified workers" [Manufacturing Institute Report, 2012], and recognizing the aging generation of their current workforce, expect a severe labor crisis when they retire [Streb, Voelpel, and Leibold, 2009]. The manufacturing industry is unable to fill vacant technician positions, due to a labor shortage of skilled workers [those falling between unskilled labor and engineer], and are sometimes forced to place engineers in technician roles- resulting higher labor, recruitment, and turnover costs [Roesset and Yao, 2000].

Although the talent pipeline has several points of disconnect, one that industry leaders have increasingly identified targets the US education system. Citing this disconnect, automotive manufacturer Volkswagen recently stated that they "can only maintain their global standard by utilizing their own training and education measures," and have created their own internal training programs for employees using approaches similar to the German Dual Education System [VW 2013]. Because the future of industry, and its ability to globally compete, is contingent on the competence and skill of its workforce, educators play a pivotal role in their success and/or failure. Companies rely on educators to supply a higher level of entry-level skill so that they can minimize their training costs. If educators are unable to meet industry's talent demands, as currently indicated by the national skill gaps, manufacturers like Volkswagen will continue to increase their investment in employee training and view colleges as increasingly irrelevant. This solution, however, fails to address the bulk of the manufacturing industry.

Although larger companies have the knowledge and resources to implement internal training programs, both the federal and Michigan state government have recognized the need for education reform amongst community colleges, so as to meet the talent needs of suppliers and other [smaller] manufacturing sectors. In doing so, the Michigan Economic Development Corporation [MEDC], directed by Governor Snyder, brought together a group of government, industry, and education leaders in June 2012 to discuss the comprehensive education reform needed to address the current skills gap in Michigan. The product of this meeting, what is now called the Michigan Advanced Technician Training [MAT^2] Mechatronics Program, is the pilot implementation of a dual education system and is driven by three primary stakeholder groups:

1. State Government/MEDC: providing the framework and political support to standardize, manage, and maintain a successful state-wide education system
2. Industry Partners: defining content and direction [professions, skills] of MAT^2 programs, and hiring students into the program[s]
3. Education Partners [community colleges]: proving the competency-based education and training for both students [going through the program] and companies [as trainers/employers]

An initial benchmark study indicated both the need and potential success of a state-standardized dual education system, so the state, with support from their initiating industry partners, agreed to act proactively- targeting a Fall 2013 pilot launch. The agreed vision was to establish a

competency-based dual education system [piloting a mechatronics program], train globally competitive employees, and to reduce the current/future skills gap.

2. Partnership Approach – The Stakeholder "System"

It was clear that a complex "system" of stakeholders needed to be utilized in order to drive the program targets and execution [Figure 1]

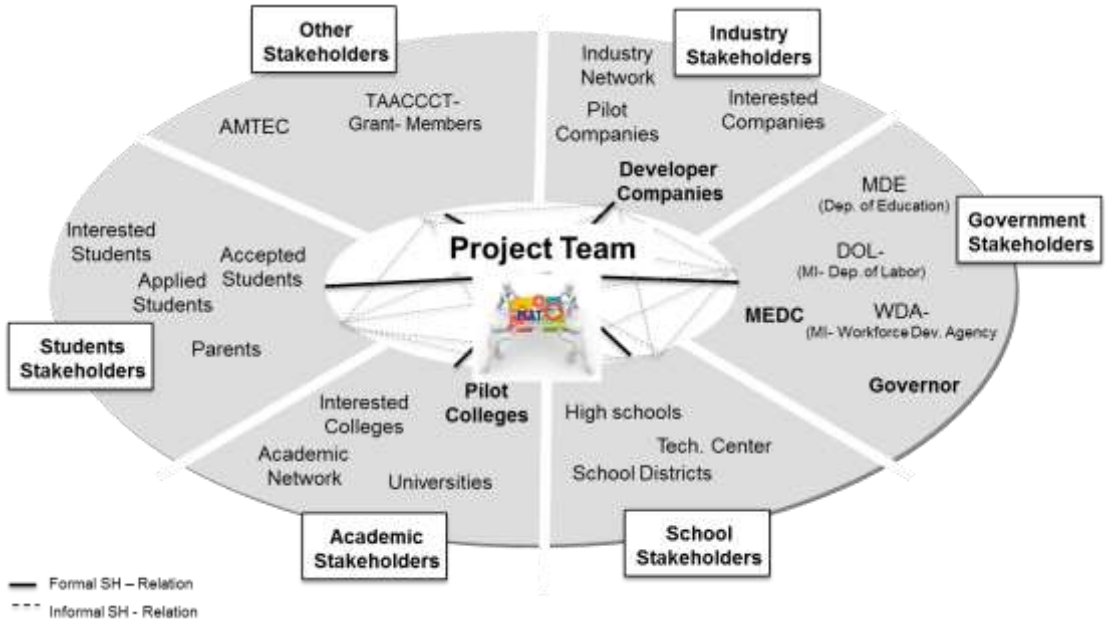

Figure 1: Complex Program Stakeholder Portfolio

It was determined that each stakeholder group was composed of subset groups, all willing and able to engage in the process, which represented a unique role in the program management system. The resulting necessity of stakeholder management created complexity in the project management scheme. Some of the stakeholder details are as follows:

- Industry Stakeholders
  - Developer Companies: companies who participated in the June 2012 benchmark and discussion meeting, and who later dedicated significant time and resources to the curriculum and program development. Such companies represent the MAT^2 industry partners on the [pilot] MAT^2 steering committee.
  - Non-Developer Companies: companies who are committed pilot partners, but have not [necessarily] participated in the curriculum development. Were recruited for the MAT^2 pilot, so were one considered as interested companies.
  - Interested Companies: potential MAT^2 pilot companies. Depending on level of interest, they are categorized as either cohort 1 [2013] or cohort 2 [2014]. In order to launch a successful pilot program in 2013, company recruitment was necessary. Once an interested company is officially considered a MAT^2 partner, they are put into the "non-developer" category.

- Educational Stakeholders
  - Pilot Colleges: the [2] community colleges developing and piloting the MAT^2 mechatronics program.
  - Interested Colleges: potential MAT^2 colleges. Depending on level of readiness [i.e. industry partner, administrative, curriculum, facility, etc.], they are considered for a MAT^2 launch in 2014. College recruitment and acceptance is needed in order to meet the vision of a state-wide dual education system.
  - High Schools: MAT^2 targets high school seniors preparing for graduation. Teachers, counselors and district-level administrators are needed to recruit a potential pool of applicants.
  - Universities: in order to achieve the vision for a "portable credential" [i.e. have the MAT^2 program articulate to a 4 year program], universities need to be consulted and partnered in the early development stages.

- Political Stakeholders
  - Michigan Governor: the state-wide acceptance and recognition of MAT^2 is dependent on involvement from the state leaders. The governor influences and directs the funding, support, and power of MAT^2.
  - MEDC [MI Economic Development Corporation]: as the economic arm of the Michigan government, the MEDC is the primary political stakeholder for MAT^2. They direct, market, and maintain [as a state-standard program] MAT^2.
  - DOL [Department of Labor]: as the governing body of registered apprenticeships in the US, the DOL has networking and political power both at the state and federal level. Additionally, they fund the education grants [helping to develop MAT^2 curriculum] held by both pilot MAT^2 colleges.
  - MDE [Michigan Department of Education]: as the governing body of the state's education system, they can influence [most significantly] the curriculum offered to students in preparation of MAT^2 [i.e. K-12]
  - MI WDA [Workforce Development]: they share the network and industry knowledge needed by MAT^2, and can bring political influence and companies to the program.

In order to reflect and consider the interests of primary stakeholders groups, they are represented on a MAT^2 pilot program Steering Committee [SC]. The complexity of their stakeholder interests was addressed by the formulation of a [SC] jointly developed Letter of Intent, which was signed with the understanding that a partnership approach would be critical to achieve the program targets. Although partnership principles within education projects are not unfamiliar, the level of partnership and involvement required of MAT^2 partners is new because a] the concept of both competency-based education is unknown [or at least practiced] in the US, b] colleges, who are traditionally independent, must meet both industry and state demands for common standards via a German model for dual education, c] industry stakeholders, who are typically competitors, are required to form partnerships – "coop-petition" [**Coop**eration in Com**petition**] and d] the urgent need and crucial impact of such partnerships evident in many industries but often not successfully established [Barnes, Pashby, & Gibbons, 2002].

The importance of Partnership principles are well-known from various industry projects – if well considered, they allow for the creation of needed trust, fair treatment, sufficient transparency and a high conflict competence between partners [Baumann, Jacobs, 2012], [Baumann, Spang, Albrecht, 2010], [Baumann, Holzinger, 2010]. Because this level of

partnership involvement was unfamiliar, the clear definition of partner principles and common goals was required. For industry competitors, the common [cooperative] goal is to create an accepted state-of the art profession, by defining the core skills and competencies needed to succeed with any industry partner and/or sector utilizing it. In the case of the MAT^2 pilot, the field of integrated systems technology [e.g. mechanic, computer, and electric] was benchmarked, defining the core standards of a Mechatronic Technician profession. In order to achieve an industry-recognized quality standard, individual companies need to form a unified voice for educators. Additionally, partnerships between competing educational providers require that they collaborate to develop a standardized state-wide curriculum, testing, and delivery methodology. For the MAT^2 Mechatronics Pilot, two community colleges were engaged. They had to overcome self-serving motives to be the only and/or better program provider.

All the defined stakeholders were included in the "partner culture" of the MAT^2 organization; therefore, the project considered them within the scope of stakeholder management and had to define a target system which was agreeable between them [Baumann T., [2012]], [Baumann T., [2011]], [Spang K, Albrecht J. Baumann T [2011]]. Recent developments in neurobiology, specifically the decision making mechanism of humans [as individuals as well as social systems] have been transferred into the business and project world, creating new partnership results and supporting a "stakeholder system" approach. [Könneker, C.(2006)],]Roth,G., (2007)]

3. Program Target System

The program targets are driven and defined by the [most powerful] stakeholder's interests – as seen in many projects [Baumann, Schmitz, Fajerski, 2011], [Schelle, H., Ottmann, R., Pfeiffer, A., 2006]. During the MAT^2 benchmark study, the primary stakeholders and their respective interests were identified; a formal stakeholder analysis during the project's inception later defined those interests as the main program targets. A formal target system was defined, and established clear "focus" targets [figure 2] for "target reliability evaluation" during the entire program course. The main program targets, however, had to align with the overall MAT^2 program vision:

> **Vision Statement:** "The Michigan Advanced Technician Training Mechatronics Program [MAT^2] is an innovative and industry-defined approach to education which will offer companies competent employees, young adults a financially viable education and career pathways, and Michigan a talent pipeline of skilled workers. Benchmarked on the German Dual Education System, MAT^2 is an educational model developed in conjunction with global technology leaders, and will combine theory, practice and work to train a globally competitive workforce. Michigan is working with industry, education and public partners to achieve nationally and internationally recognized dual education standards and to support competency-based education reform. The State of Michigan will continue to support MAT^2 and its vision for change, and is moving towards state-wide implementation of the Michigan Advanced Technician Training programs. Mechatronics represents the first avenue in MAT^2, as Michigan will continue to develop and implement additional MAT^2 professions in order to meet industry needs and global standards."

Figure 2: The Program Target System

4. Program Management Approach [Background]

In order to meet the defined targets: 1] a clear understanding of all interested parties, 2] the work scope [including different projects] and 3] the definition, planning and implementation of the program systems needed to be approached with a strong program/ project management. The existing circumstance and/or system, however, were not amenable to this approach. There was little to no transparency between the existing [similar] programs in MI, resulting in insufficient knowledge about the feasibility [resources, experience, political and academic support, funding] of establishing such a program.

Consequently, a benchmark and feasibility study [pre-project] [Eskerod, Jepsen, 2013] was needed to inform objective criteria and to determine a realistic approach [budget, timing, organization, risks …] for starting a program [as defined by the targets above]. The contracted study benchmarked existing MI-programs [specifically Mechatronic and/or industry-led] with the German System Dual Education System- because it is often recognized as the "Gold Standard" for apprentice training [Wiesmann, 2012].

Nine Michigan-based programs were compared with the German System using a weighted multifunctional Competitive Strength Assessment [Thompson, Peteraf, Gamble, Strickland, 2012] [figure 3].

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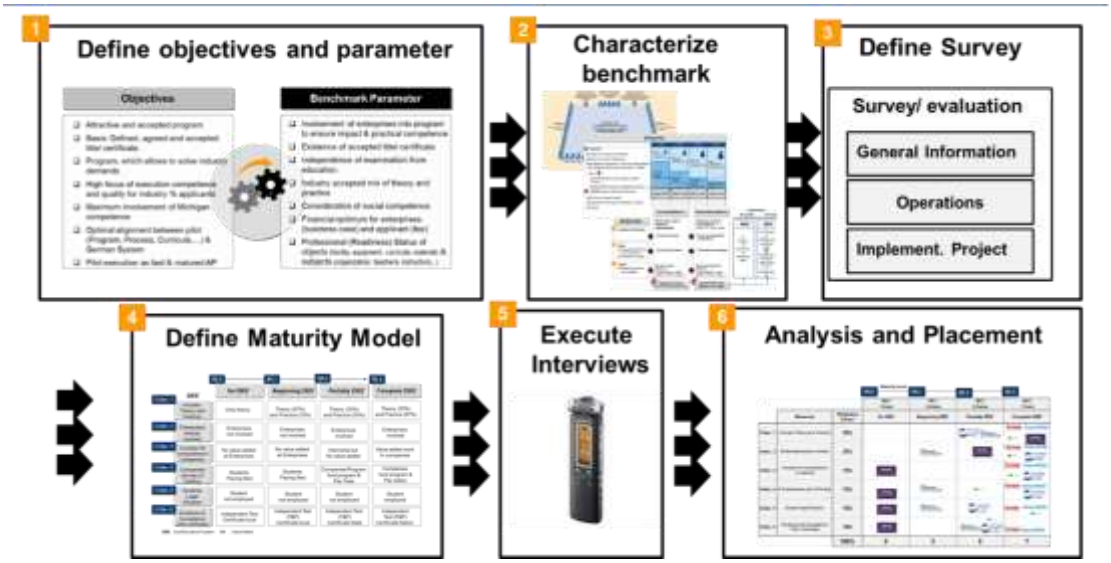

Figure 3: Benchmark Process for Defining the Program Content and Targets

The benchmark results indicated that the existing Michigan programs were often very customized to regional needs and were often limited in their ability to meet comprehensive industry standards; therefore, none met the defined benchmark criteria. Conclusively, it was determined that a dual education system was feasible in Michigan, and that there was the political support, industry demand and system [academic, industry and political] capability to develop and implement a pilot within one year.

The common feasibility statement and adjusted target system was subsequently released [figure x] by the development partners [initiating stakeholders], and an official program management approach was implemented to ensure a matured project planning, execution and controlling/monitoring of the very aggressive and complex [dynamic and involving] project [Commonwealth of Australia, 2006].

5. **Program Organization [**Figure 4]

A program of such complexity [new academic approaches, new requirements for US companies, uncertainty about project scope, involvement a many influential stakeholders, etc.] and an aggressive time line required an extensive deliberation about the necessary program organization and management approach. Therefore, an organization focused to the success of all its stakeholders [factors specified in program vision] was established [figure x], allowing the program [1] to consider all crucial stakeholders [2] allow fast and lean decision processes and [3] provided a solid foundation for the needed program management.

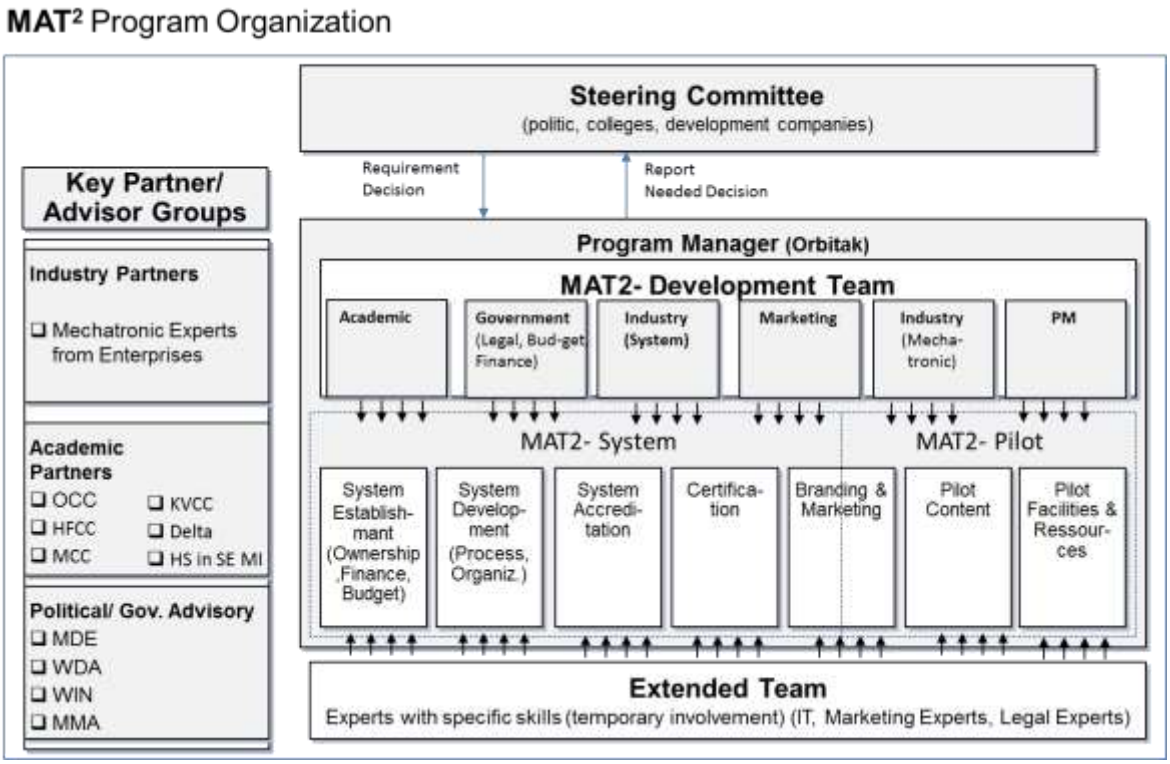

Figure 4: Program Organization

The MAT[2] partners [represented by the steering committee members] agreed to a disciplined program management, understanding that their PM experiences varied greatly. Industry [particularly automotive] typically utilizes time lines, planning and controlling, and risk management for a structured PM approach– all PM elements described within the IPMA – ICB[2] [IPMA-ICB, 2010]. Academic institutions, however, are not familiar with mature, controlled program management, and follow a garbage can approach – floating streams of choices, problems, energy of participants and rate of flow of solutions [Cohen, 1972]. In order to ensure process, content and communication harmonization between stakeholders, a transparent program management understanding had to be established with the "inexperienced" colleges. Therefore, a significant commitment to program management [from the participating colleges] and an active involvement on the Steering Committee were key success factors.

6. Program Planning and Monitoring

The program management established the [typical] crucial structure and elements for program. They will not be described in detail because of the paper limitations.

- Project work breakdown structure [WBS]- including the defined work packages
- Resource planning and monitoring
- Time planning and monitoring
- Budget planning and monitoring [contract between state and colleges]
- Risk management
- Reporting, evaluating and updating system

[2] IPMA-ICB- International Project Management Association- IPMA-Competence Baseline

It is important, however, to highlight the change management system implemented for the program's development and implementation.

7. Change Management

The program [as described above] created a complex stakeholder system, and as a result, had to establish a solid partnership culture. This not only created a reputable program image, but allowed MAT^2 to plan and manage possible change related problems/ obstacles; therefore, change management was a permanent program function. The success of this partnership, and the overall program, thus required an active leadership from both the program director and steering committee, as active management involvement is identified as a well-known key success factor. [Baumann, Schneider, 2010], [Baumann, Delgado, 2007], [Baumann, Kruse, 2007], [Dworatschek, Kruse, Baumann, 2002], [Baumann, Nehlsen, 2006].

It was clear that the program execution required stakeholders to think outside of their familiar context, and adapt to redefined role concepts- particularly for the colleges and industry partners developing industry-driven competency based education. One crucial element for facilitating an efficient and successful "change behavior" was the establishment of partnership rules, in conjunction with their correlated mindset and/or discipline change [figure x]. For example, the MEDC [representing the state], signed a Letter of Intent with every participating partner college and company. This not only formally defined the program rules, standards [i.e. payment model, reporting model, instructor requirement and minimum employment contract elements], and responsibilities for each stakeholder, it outlined the program vision for paradigm change. In doing so, "equal play" principles- which are typically not seen in the American market- were established to ensure long-term success of the system and its stakeholders.

Marketing was also a critical element in supporting the change management. The development and execution of a MAT^2 logo, webpage, video messages [from company CEOs and the MI Governor], fact sheets, banners, presentations, and interviews were all effective tools/methods for communicating the brand message and changing the social stigmas surrounding technical education. They, in conjunction with high school and college applicant recruitment events, enabled the program to explain its targets and vision to participant stakeholders [parents, students, teachers and school administrators].

8. Program Status/ Outcomes

The skill gap in manufacturing is not unique to Michigan, nor is the needed solution; therefore, achieving the MAT^2 program targets was essential in comprehensively meeting the needs of advanced manufacturers, industry, academic and [potential] workforce stakeholders and restoring an accessible, globally-competitive talent pipeline.

Because of the limitations of this paper, the program status and [current] outcomes will be briefly reviewed. The MAT^2 pilot program [Mechatronic Technician] of over 30 students, 10 companies, and 2 colleges will launch on September 16, 2013- on time and on budget. The following targets [figure 2] were met using the change management system:

1. *Standardization*: while the MAT^2 Partner Letter of Intent defined the role and responsibilities of each key stakeholder, the partnership and standardization deliverables were defined using an internal [between the pilot community colleges] contract. Both colleges will offer the same curriculum [including program and course level outcomes], and are jointly developing and/or implementing a set of standardized competency-based

assessments [MAP- MAT[2] Assessment Protocol]: [1]Mechapractica- capstone projects at the end of each school period, [2]AMTEC post-course assessments, [3]Yearly MAT[2] [state] cumulative exams, and [4]Michigan Mechatronic Exam.

2. *Degree/Certificate*: graduates of MAT[2] will receive an extended associate's degree, Department of Labor certificate, and German [Industrie-und Handelskammer] certificate. This certifies the program both nationally and internationally, and will provide a national model for competency-based apprenticeships.

3. *Portability*: the MAT[2] mechatronic curriculum was developed using the DACUM approach [Willet J., Hermann, G., [1989]], and required the developer companies to participate in a task analysis. In doing so, the program developed the core standards of a mechatronic technician, which serves as the fundamental measure of all academic content and standards, and is not specific to any industry sector. Because the college-taught content correlates to the original task analysis, allowing students to work in any integrated systems field, work assignments are designed to master and customize the core competencies so companies can "grow their own employees."

4. *Quality*: the program partners demanded high quality standards so a formal review and release process was developed and implemented by the program management. The following quality standards are a product of this process:

    - Program Content/Quality: the mechatronic task analysis [DACUM process] was industry lead, and defines all the standard competency-based assessments. All of which must be reviewed and formally released according to the defined industry release process and timeline [figure xx].

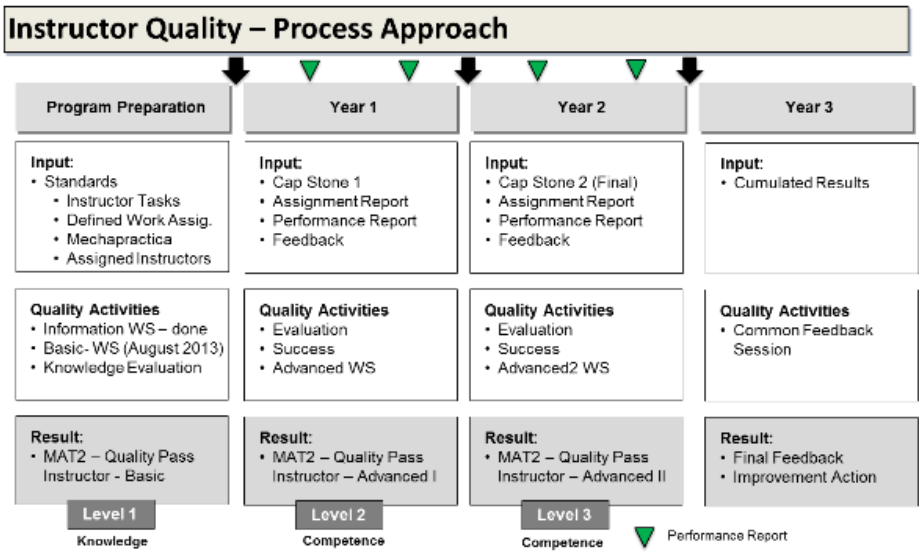

Figure 5: Quality Principles for Instructors and Colleges

- College Faculty and Company Instructor Quality- a standard qualification and certification program for college faculty and company instructors was established, benchmarked on a European Evaluation [Haasler, Tutschner, 2011], and was completely unfamiliar to American companies because they are typically not as involved or responsible for educational success [work assignment].

- College Quality: readiness standards for colleges who want to participate in MAT[2] have been developed, requiring interested colleges to meet content, facility, administrative and faculty requirements [figure 6].

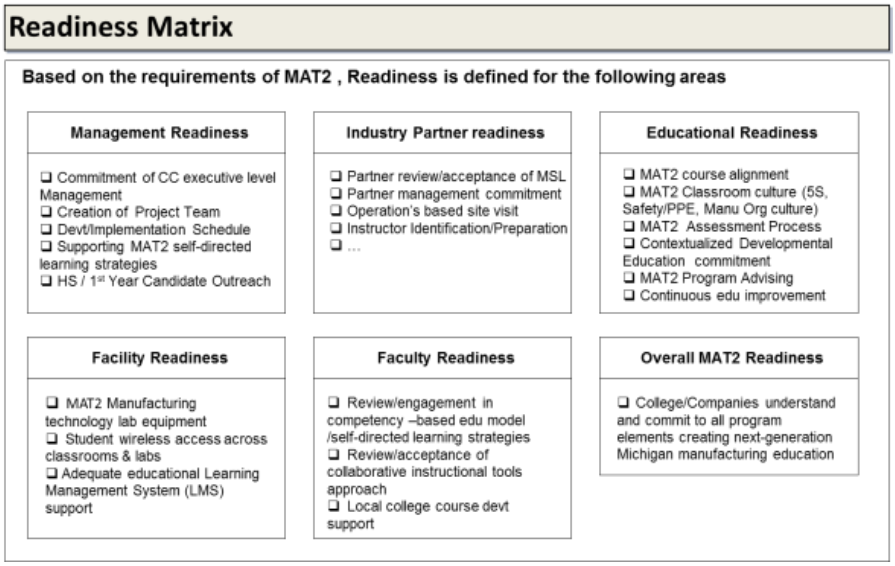

Figure 6: Application Principles for Colleges

- Applicant Quality: a standard five step application process included an [1]online application and resume submission,[2] academic placement test, [3]company fair and initial matching [between candidate and company] process, [4]personality and motivation assessment with mechatronic profile matching, [5]company interview and internal test, and [6]decision and contracting stage.

5. *Duality Maturity*: the MAT[2] learning content is more than 2/3 "hands-on", and stems from both mastery learning and competency-based education theory [Kulik, Kulik, & Bangert-Drowns, 1990]. Content also considered the industry requirements regarding holistic, systems-based thinking and problem solving [e.g. project management, communication and quality management courses will be provided]. Additionally, general education competencies [writing, math, etc.] are taught and evaluated during training exercises; thus, reinforcing mastery learning principles and giving students opportunities for applied application and, if necessary, remediation.

6. *Extendibility*: strategic collaborations with other national education reform initiatives, identified through the stakeholder analysis, allowed MAT[2] to leverage their resources and maximize target achievement. The collaborative initiatives include:

    a. AMTEC[3]- a collaboration of community/technical colleges and industry partners who seek to better prepare highly skilled technicians and manufacturing engineers for work in automobile manufacturing and technology [AMTEC, 2013]

    b. M-SAMC[4] TAACCCT Grant[5]- a national innovation and competency-based education reform grant funded by the DOL[9] [TAACCT, 2013]

7. *Responsibility*: all program partners contribute to the success and target achievement of MAT[2]; however, the companies successfully implemented strategies for social responsibility, agreeing to employ and pay for their students [tuition, school stipend, wage] during the entire program duration.

9. Outlook: future state-wide and [inter-] national transfer options

The defined program management approach, organizational structure, and defined standards are designed for state-wide system expansion [additional cohorts and programs]. The development of a MAT[2] handbook, certified by ISO 9001, will not only improve its transparency and transferability, it will enhance the quality of the existing program. Potential colleges and companies have already been introduced to the needed requirements and assessment criteria for MAT[2] partners; thus, a state-wide needs analysis will be conducted in order to determine the optimal strategic development/expansion [i.e. where and with what program] of MAT[2] across the state. Additionally, MAT[2] content and training standards can be used to create educational pathways [i.e. articulation agreements] from K-12 into MAT[2], as well from MAT[2] to four year degree programs. Because MAT2 will collect comprehensive information from a variety of stakeholders and program areas [via reports, feedback, evaluations, etc.], and will require complex user and analytic functions, it will need to create an innovative Learning Management System [LMS]. This will allow the program management to provide accurate conclusions and recommendations for enhancing the program's scope and quality, as well as provide a LMS model for national initiatives.

The strategic partnerships with the DoL, M-SAMC[7], and AMTEC[6] are providing MAT[2] with the national resources and network to develop system-level innovation and quality standards. Because the DoL manages the entire US registered apprenticeship system, which is typically structured around time-based completion requirements, MAT[2] represents a feasible model for DoL competency-based education reform. Registering the MAT[2] companies and apprentices will allow for out-of-state use [for both MAT[2] and non-MAT[2] companies], giving it immediate national impact.

[3] AMTEC- Automotive Manufacturing Technical Education Collaborative
[4] M-SAMC Multi State Advanced Manufacturing Consortium
[5] TAACCCT-Trade Adjustment Assistance Community College and Career Training Program
9 DoL- United States Department of Labor

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About the Authors

Thomas Baumann

Orbitak International LLC
Troy, Michigan, USA

Thomas Baumann, born in 1960 studied physics. After some years in the power plant industry he got in contact with the matter of project management and joined a management consultancy. Using his experiences in the power plant and offshore industry he implemented project management in international and global acting companies. Later he joined the large German Automaker Volkswagen AG as principal of the Volkswagen consulting and was responsible for the strategic development of the component plants esp. in Germany. Because of his strong ties to project management field he was asked to establish and manage the center of competence of PM of VW in Wolfsburg, Germany. Later he became the leader of Business Processes and IT-Strategy at Volkswagen of America in Detroit, USA.

Today Th0mas is Director of the Orbitak Consultancy company and CEO of the Orbitak International LLC in Detroit USA. Since more than 20 years he is working/leading consulting projects & programs mainly in global acting enterprises in the automotive & supplier, public, education and banking industry. Mr. Baumann is specialized in the fields of strategic consulting, business processes and project management- especially PM-maturities and new trends in project management. During the last years he was focused on the transfer of results from fields like expertise research, neurobiology and complexity management into practical hints for the field of (project) management about which he published several papers. He also is specialized in setting up and managing complex projects within the educational sector where politics, industry and academic providers have to partner.

Thomas Baumann won with his colleagues Manfred Saynisch and Dr. Louis Klein the 2010 International ICCPM research prize. Thomas can be contacted at Thomas.Baumann@orbitak.com.

Sarah Harfst

Orbitak International LLC
Troy, Michigan, USA

Sarah Harfst is a consultant for Orbitak International LLC, the US subsidiary of a German-based management consulting company. She graduated from Michigan State University having focused on research and evaluation, and has worked on state-wide systems change initiatives like the National Youth Leadership Initiative. Currently, Sarah consults in the development and project management of the Michigan Advanced Technician Training Program (MAT^2) Mechatronics Program and the Multi-State Advanced Manufacturing Consortium Grant.

Amy Cell

Michigan Economic Development Corporation
Lansing, Michigan, USA

Amy Cell is Senior Vice President of Talent Enhancement for the Michigan Economic Development Corporation. Her primary focus is to direct programs to attract, retain and develop talent for the state of Michigan. Prior to joining the MEDC in 2011, Amy was VP, Talent Enhancement & Entrepreneurial Education at Ann Arbor SPARK, where she assisted organizations with their talent needs, provided oversight for a variety of entrepreneurial education programs and managed the SPARK East incubator. In addition to working as a CPA for Plante & Moran, and launching an Office of Student Life for the Ross School of Business at the University of Michigan, she has spent 10 years in a variety of human resources roles at Ford Motor Company, the Stanford Research Institute, Applied Biosystems and co-founded the consulting partnership, HR Drivers.

Current and past board memberships include the Center for Entrepreneurship at the U-M College of Engineering, Women's Council for Washtenaw Community College, Huron Musical Association, Women's Exchange of Washtenaw, Ross School of Business SE Michigan Alumni Club, Kingcare, King PTO and the Junior League of Ann Arbor. Amy received her BBA and MBA from the University of Michigan.

John Dunn

President, Brose North America

John Dunn has been responsible for Brose activities in North America since August 1, 2012. John Dunn graduated with degrees in engineering from Purdue University and the University of Wisconsin. After joining Brose North America as Director for General Motors Door System business in 1998, he was appointed General Manager of the Chicago plant in 2002. From 2007, John was Chief Operating Officer in charge of production sites in the North American region. For two years during that period, he also held the position of Vice President responsible for global door system sales to General Motors.