Managing successful project teams in a diverse stakeholder environment: Merging industry best practices with an education system to address critical human factors

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Abstract

Across the United States, industry, education and government stakeholders are redefining their partnerships in order to address and reduce critical skill gaps in the current workforce. This represents a paradigm shift in technical and professional education, as well as the collaborative processes utilized in creating and maintaining complex multi-stakeholder talent development systems. In doing so, however, this paradigm shift also presents a huge challenge: education and public sectors are typically not familiar with matured product development and (project) management principles and often do not apply proven industry practices to the definition, design, delivery and improvement of their educational products. The evaluation, acceptance and ultimate implementation of those principles departs from the traditional (United States) culture of education, as it applies new instructional design processes, change implementation processes, and feedback/assessment models. Therefore, critical review of such methods, innovative development of transfer options and human factors management in successfully achieving the required systems change were identified, and include explanation, understanding, acceptance, personal development, and trust. Using a case study approach, this paper will analyze several highly visible and innovative adaptations of industry and educational standards which were accepted and released by all relevant stakeholders. By leveraging subject matter experts from both the industry and academic settings, Michigan Advanced Technician Training (MAT²) formed organizational and working teams comprised of the primary government, industry, and academic stakeholder groups and established a workable context for a knowledge transfer of best practice industry standards.
Said standards were applied bi-directionally by academic providers and partnering manufacturing enterprises, and now serve as best practice examples for post-secondary systems of apprenticeship education.

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1. Introduction

MAT²’s education system deliverables (including industry releases, apprenticeship model training, content standardization, national and international benchmarked credentials) were initially established in order to drive the change process through the subsequent selection of best-practice standards. Each project phase (initiation, concept, design, pilot/launch, redesign/enhancement/ improvement/termination) then focused on its own key deliverables and the critical human factors in developing and managing to those outcomes. As a result, industry best practices were successfully adapted to those MAT² system. As part of each program’s design phase, QFD- Quality Function Deployment methodology was established as an instructional design standard. Through this process, industry partners defined the importance of each program-required skill and/or task using a 1-3-9 scale, providing the academic institutions with a specifications roadmap for program content design (e.g. content depth and importance). Likewise, once the academic institutions defined the course outcomes and objectives to meet the specifications roadmap, they were aligned with the initial industry QFD. Once the alignment had been industry-reviewed and released, standard Program Management elements were established during the program development phase. Scope definition (WBS) and related milestone reporting were used within the cross-functional industry and educational partner development team, and facilitated the needed common application, transparency and discipline processes.

During the program delivery, methods were taken from the industry to assess and improve the program content, outcomes and success. A 360-Degree Feedback system was instituted which used periodic (online) program feedbacks from students, academic faculty and administration, as well as industry. To understand exactly why, when, and where enhancements are required at the program level (e.g. the Mechatronic program) or at the entire system level (MAT² system) the industry methods of Business Process Reengineering (BPR) and Configuration and (engineering) Change Management were put in place within the program’s improvement phase. In this framework, systems and program are defined via their “reference configuration”. Any changes to curriculum or other process improvements like delivery patterns or protocols must go through an E-CR/CM- Education – Change Request/ Management process, which permits the identification, ranking, and tracking of the approved changes thereby allowing transparency of communication and the management of configuration changes. Furthermore, changes to the configuration management or other system process were considered as part of the delivery phases’ Process Management in order to provide clear defined, released and documented core and supporting processes.

The Michigan Advanced Technician Training project represents a Systems Engineering approach to technical and professional education because it applied a holistic understanding to a complex (education) system’s individual processes and stakeholders, as well as their impact on overall performance. Ultimately, the use of the applied industry methodology increased both the efficiency and quality of the content design and delivery because it managed each stakeholder group’s expectations of the actual transfer of industry skill requirements in educational content. This approach was, and still is, crucial for project success and acceptance in a diverse stakeholder environment, so this paper presents three academic objectives: 1) the descriptive objective to describe and explain the research process used to identify the appropriate industry methods 2) the analytic objective to explain the analysis, decisions and innovative adjustment needed to successfully adapt industry standards in a diverse
stakeholder environment and 3) the **practical objective** to describe the transfer of this generic approach by using the MAT2-example and provide initial lessons learned and an overview about needed research and next steps.

2. Situational context

The MAT² system consists of stakeholders with highly divergent points of view and experiences. The mindset of each stakeholder group presents an understandable but often exclusive approach that contributes to conflict and distrust. Governmental entities measure success and progress differently than business or academic entities. These differing reference points, success factors, and approaches create a complex environment where human factors and operational success are interdependent. Most divergent is the cultural divide between academic and business points of view. Because of this, success is highly dependent upon the understanding of both human factors and the underlying mechanisms. The careful application of this understanding to maintain motivated and fair acting stakeholders is key.

The human side of the acting stakeholders includes factors and aspects like (BHN, 2013):

(A) **Personality** (What kind of reward drives a person to decide in one direction? Are the mechanisms generic or do they depend on individual personality?)

(B) **The human decision making process** (the mechanism how humans decide and act for achieving an expected reward (which basically is a biochemical reaction) which is instantly compared with the actually gained incentive (causes motivation).

(C) **Human Behavior after decision and behavioral changes** (Information, individual reception, incentives and decision process are determinants of behavior. Often it is important to change behavior to ensure alignment with our undertaken objectives (e.g. here Behavior of team members and stakeholders to line up with projects and enterprise goals)

(D) **Human Reward System** (Human need to be motivated for a specific decision. To achieve this motivation the provision of the right incentive/reward signal to the reward system is required. Therefore, we need to understand the principles behind it and the correlation to the decision making process.)

The mechanism, working principles and possible transfer recommendations have been described by us and many other authors e.g. (GRA, 1987), (LBK, 1995), (BHN, 2013), (ROT, 2007), (ROT, 2011). Especially (BHN, 2013) describes the used research methodology (literature research, empiric sources, interviews, workshops, conferences.

The main transfer conclusions (consideration of individual human decision making process for motivation of humans, enriched (emotionalizing facts) communication content to reach the limbic system to achieve behavior, consideration of intercultural aspects, consideration of generic reward and motivation principles and human factors (fairness, trust, partnership, openness, accountability,…) were considered especially in this complex context where different stakeholders with individual approaches, objectives and strategies had to be aligned to the program goals.

From an academic reference point, “Universities are by definition associated with rites of passage. European universities were originally medieval and monastic, and American institutions inherited their traditions.” Johns Hopkins University was founded on the ideal of an institution devoted to the creation of knowledge. According to its first president Daniel Gilman “First it is the business of a university to advance knowledge...no history so remote...no law of mathematics so hidden...that it may not be sought out...(by) a band of well-chosen professors uniting their forces in the prosecution of study”. This point of view was widely adopted and runs counter to a sense of urgency with specific, time based, outcomes that is more amenable to a business orientation. As this idea took root, the “well-chosen bands of professors” acquired more influence of the day-to-day running of the institution”. (DEM, 2011) It can be argued that, under this framework, the value of specific, measureable, outcomes and timelines is not a driving influence, and that the customer is the institution itself. In today’s “multi-university” the “well-chosen band” is a class society based on the ability to attract funding. The stratification of this class society (including tenure) creates the situation where “unlike secondary schools, in which a detailed curriculum is prescribed by a school board, a college curriculum reflects the desires and tastes of faculty members.” (DEM, 2011)
Rank within the academy “classes” is based on highly subjective judgments of peers and governing bodies and not necessarily on well-defined competencies that represents a more business oriented point of view. Tenure is a measure of rank and is “an institutional pledge to protect...free inquiry and classroom expression from political or other outside influence.” In the US, the concept of academic freedom reached a pinnacle in 1941-43 where the then Governor of Georgia was angered by the actions of the Dean of the School of Education at the University of Georgia. The Governor orchestrated the replacement of members of the governing board of Regents to cause a vote to dismiss the Dean. The story so scandalized the state and the nation that the national educational accrediting bodies refused accreditation to all of the state’s schools for “undue influence” and an amendment was passed that protected academic freedom in the state’s constitution. (DEM, 2011) Academic freedom remains today as an essentially sacred mantra within the academic community and, in many cases, has actively prevented the influence of industry and the use of proven industry techniques to be involved in the educational process.

Nonetheless, there are pressures on colleges today that will increasingly force new approaches to be considered if the institutions are to survive. According to Jeffrey J. Selling, author of College (Un)bound, there are five ways that Higher Education will change in the future. (SEL, 2013)
1. Technology will force a more personalized approach to instruction
2. Rising costs and less financial underwriting will force schools to use hybrid instruction (flipped classroom) to control costs.
3. The degree will be “unbundled” permitting completion at a variety of institutions/entities which will force credit transferability.
4. Completion timelines will become more fluid
5. Tuition affordability will adopt many plans and academic costs will be increasing constrained.

A plethora of technology, rising cost, and decreasing funding has many US educational leaders willing to explore new operational patterns, accept new techniques, and listen to input from previously uninvited entities. US industry is now becoming more aware that it cannot “cut” its way to prosperity. Additionally, as the workforce gap continues to expand, due to aging workforce, skill gaps in the current talent pool, and the future talent pool shortages, industry leaders have awakened to the need for active involvement in solving the workforce development issue instead of just accepting the output with complaint or demanding accommodation and customization without direct contribution (both financial, and expertise). Within this atmosphere of new awareness on all sides, the opportunity for industry / academic collaboration has fertile ground. The MAT² program leverages this atmosphere and offers a mutually respectful way of building measurable outcomes across these cultural boundaries.

3. The systems approach

The design and delivery of (new) innovative apprenticeship programs are characterized by numerous interactions between the involved stakeholders (BHC, 2013), defined as (a) the industry partners: responsible to define the industry-needed competences and release and validate the learning outcomes, (b) the academic providers: responsible to design and deliver curriculum which meets the industry-released specifications, (c) the government: responsible to provide a political environment which facilitates stakeholder “coopetition”

While the interactions between those stakeholders create, maintain and improve the MAT²- system, the stakeholders themselves are each fulfilling a system requirement: they are acting as single entities, each forming through “acting functions,” the system. Because their functions are interdependent, the system-level desired outcomes could only be achieved if they are acting in synergy; a dysfunction or change in the stakeholder dynamic

\* Competence based, industry driven dual education systems  
\† Temporarily Cooperation of competing entities (colleges, companies) to achieve a common desired status.
will impact the entire system and its intended outcomes\(^1\) (ICC, 2007). Therefore, the described MAT2 constellation can and must be considered a complex system (see figure 1).

![Figure 1: MAT2 as an acting system (principle drawing)](image)

Under this assumption, the academic theory of **Systems Engineering**, an interdisciplinary approach and means to enable the realization of successful systems (SEB, 2013), must be applied. Furthermore, this application should be considered as a holistic engineering and management approach to the design, planning, **management** and improvement of the system—here the (MAT2) system. Most notable, however, is the project management perspective on complex systems.

According to Queensland University of Technology (QUT) in Brisbane Australia (HAA, 2009a), complex projects are characterized by uncertainty, ambiguity, dynamic interfaces and significant political or external influences, and/or usually run over a period that exceeds the technology cycle time of the technologies involved, and/or can be defined by effect but not by solution. To an extent, all of the aforementioned characteristics can be applied to the MAT2 project. Creating a statewide dual-education system is inherently dynamic, as it is created and managed by three different stakeholder groups (government, industry, academic providers). All have different roles in the system and impart significant and unique external influence. Because the very nature of the project is driven by its intended **effect** on the current and future workforce, the program(s) educational content will need to keep pace with the industrial customer’s (e.g. employer) technology, and will, as a result, become outdated before it can be universally adapted (i.e. implemented at ALL colleges).

Applying the project complexity model version2 (HAA, 2009b) parameters (size, time, costs, team composition, urgency, flexibility of cost, time, scope, clarity of problem, opportunity and solution, risks, requirement volatility, strategic importance, political implications, stakeholders, level of change, risks and dependencies), the MAT2-project would be defined as a highly complex project. Such complex projects require an understanding of the nature of complexity, dynamic character (not time stable), and impossibility to plan or predict the future trajectory of the system (MAT2) (SBK, 2010), so the successful adaptation of complex project management (CPM) is necessary and includes: (1) Diagnosing complexity, (2) Assigning competent Leaders, (3) Use of the “right” Project Cycle and (4) Management of the Complexity Dimension. Although this paper is limited, and cannot address those elements in their entirety, it will attempt to diagnose their critical relevance through the MAT2 project context. In doing so, the authors will ask, “can traditional (linear) industry engineering and (project) management methods be transferred and managed to master this complexity with a “Hybrid Complexity Dimension”?”

Because of the unstable and unpredictable configuration of complex projects, an agile (management) approach was utilized to define and adjust the MAT\(^2\)-configuration. This required from the PM to define a “way of

\(^1\) System – a system is a number of parts acting as a single entity – it functions as a whole through the interaction of its parts. A key aspect of systems is that if you change one part of a system, you in fact change the whole system (ICCPM, 2007)
incrementally and recursively engaging in a management cycle of planning, controlling, feedback, and change direction (accordingly) (WER, 2012). More specifically, linear engineering and management principles (management 1st order) were adopted, allowing the PM to handle the system within more predictable project phases in coexistence with CPM (management 2nd order). In order to maintain agility, a structured change management was implemented to handle, track, and manage the continuous change process, both organizational (i.e. stakeholders) and product (i.e. curriculum, tests...), of the system and its interrelated elements. The established MAT2 organization was designed to maintain this level of complexity, as it is characterized by a coexistence of horizontal (hierarchic–within the individual programs) and vertical (hierarchic- within MAT2 system, between program(s) strategic levels) architectural patterns (BSN, 2007), (SIN, 2003), (FOE, 2004). Within that MAT2 (project) architecture, each MAT2 program universally implemented validated industry methods, including: quality methods (QFD), configuration management, dynamic recursive business process reengineering, recursive feedback loops, and continuous improvement.

4. Program life cycle management - PLCM

As described above, MAT2 is continuously evolving the overall system as well as its programs. The current programs- Mechatronics, Information Technology, and Technical Product Designer- each fulfill the core system requirements, or core assets (CMU, 2013) strategically outlined by the MAT2-system (figure 2).

To identify the most optimal transfer options for linear methods (1st order) into the complex system (2nd order) the product life cycle of the MAT2 program(s) needs to be understood, as well as the actions and interactions of the MAT2- stakeholders. This understanding is crucial to ensure the acceptance, support and application of those methods in a system environment where the diverse stakeholders each have different likelihoods of accepting and/or mastering those methods. Therefore, transfer success is highly correlated with its ability to adapt in the academic environment; the methods must evolve to meet the needs of an increasingly industry-driven academic landscape, and ultimately support an accepted, sustainable transfer configuration.

Figure 2: MAT2 - interaction system core assets and program life cycles
Each phase within the program lifecycle must consider which industry-accepted methods could be applied. This evaluation and decision process followed a clear set of parameters, 1) comparison of the expected information (quality, time, performance, etc.) to the degree of necessity, 2) understood reason and potential benefit in implementing the method during the current program lifecycle stage, 3) predicted acceptance by each stakeholder group- academic, industry and government, 4) assumed maturity or ability to adopt by each stakeholder group. In following the standard evaluative process described above, MAT2 identified optimal approach(s) for managing the stakeholder dynamics and objectives specific to each program phase.

The MAT2 program life cycle and applied industry methods are shown in figure 3, however, the following description focuses on phases 1-5 of the program lifecycle.

**Phase 1 – Initiation**

**Content and Deliverable:** During the initiation phase, the MAT2- system must decide on the need and/or feasibility of a proposed (new) program (associates degree/ trade). Sufficient information needs to be available in order to identify the possible steps in realizing a program launch under the MAT2 core system requirements. Additional stakeholders and partners may be recruited as needs are identified during this phase. (New content and new partnerships)

**Needed Information:** Evaluators must consider the current and future industry demand, readiness of potential academic providers (management, faculty, equipment), as well as the career and income projections for the proposed profession.

*(Industry) Method of Execution:* Common Market Research methods, such as surveys, interviews, need analyses, were used to collect the needed information. With that information, a cost-benefits analysis is conducted to factor in the economic prospective.

**Phase 2 – Concept**

**Content and Deliverable:** During the concept phase, industry partners identify the skill requirements for an identified profession through a detailed task analysis. This serves as a curriculum-specifications roadmap, and is intended to represent global industry standards (relevant to that profession).

**Needed Information:** Industry experts lead the content definition, and are required to have an in-depth knowledge of the profession’s skill requirements, industry relevance, and career pathways. The task analysis must also consider international or national standards (programs, credentialing, etc.).

*(Industry) Method of Execution:* A Benchmark Analysis, characterized by indicators, criteria, weightings, etc., was used to identify the current best-in-class standards. A QFD*-Analysis was used to identify the industry’s perception of the importance of each of these skill requirements so that expectations of content time, attention, and depth could be communicated and to identify academic gaps.

**Phase 3 – Design & Development**

**Content and Deliverable:** During the design phase, the product (associates degree program) and its content (course materials, syllabus, performance-based learning outcomes, and competence evaluations) must be developed and released for industry review.

**Needed Information:** The scope and development activities (what, when, how) must be clearly defined in the context of (academic provider’s) current vs. desired state.

*(Industry) Method of Execution:* Professional Project Management (BHC, 2013)) and synchronized Product Development Process were utilized in managing each program’s design and development.

**QFD- Quality Function Deployment**
Phase 4 – Pilot/ Launch

Content and Deliverable: In the Pilot/Launch phase, the realized MAT2 product (newly developed competency-based dual education program) must undergo an initial pilot launch to ensure that all product features are meeting industry expectations and that the established processes are efficient and effective. This phase starts and ends with the first pilot cohort.

Needed Information: Product and process performance information is required from all stakeholders in order to provide comparable analysis to the defined MAT2-success factors.

(Industry) Method of Execution: Systematically executed Handover-Processes from developer to product manager, as well as industry-validated customer satisfaction methods (product clinics, focus groups, 360 degree feedback, success factor criteria, weightings, standards, etc.) to identify the current performance status were used. Also ongoing PM and BC-Management applied.

Phase 5 – Redesign/ Enhancement through Phase 6&7 (Standard application, Termination)

Content and Deliverable: The redesign/enhancement phase is executed in parallel to phase 4. Experiences, leanings and data from the pilot inform process and/or content improvements in both the current and future MAT2 programs. A structured approach is needed to define the system and program configuration as well as to manage and track changes.

Needed Information: Stakeholder input, ideas to improve (product, performance), status of changes and performance information (before and after the changes) are all necessary for the system and programs to successfully evolve.

(Industry) Method of Execution: Methods to define and manage configurations (configuration management) Professional Industry (Engineering) Change Management, professional methods to identify and manage process changes (Business Process Re-Engineering- BPR), ongoing PM and BC-Management was all used.

Figure 3 MAT2- Program Product Life Cycle
In managing a complex system comprised of three fundamentally different stakeholder cultures, the identification of appropriate, transferable industry methods is a critical first step. Once selected, however, there must be an appropriate level of motivation (or incentive) for each stakeholder to embrace the new methodology. This begins by creating an understanding of the method’s original industry application as compared to its intended adaptation or “desired state.” With that common understanding, all relevant stakeholders must reach a final agreement to support and adopt the methodology, with the understanding that it uniquely benefits each of their stakeholder groups (ROT, 2007). In breaking down the MAT2 programs’ lifecycle, Complex Program Management can effectively evolve the proposed industry methods to achieve accepted, context-relevant transfer configurations.

5. Program Lifecycle-Management with industry methods: the transfer approach

As mentioned above, this articles focuses on the transfer of specific linear methods (management 1st order) to improve the management of MAT2 as complex project (management 2nd order). Three main areas of transfer have been identified: (1) Process-Management, (2) Project Management and Quality Management.

For each of the identified areas, a standardized transfer process was used to ensure their successful application of linear methods within MAT2. Because the standardized process is beyond the scope of this paper, only three discrete methods, QFD, ECM, and BCM†† (one from each area), will be described in detail (see also figure 4). All followed standard adjustment and application steps:
1. Identification of Method(s)
2. Method Adjustment to new Context (MMM: MAT2 Method Match)
3. Implementation Release/Approval
4. MMM-Pilot
5. MMM-Anchoring within the MAT-System-Standard (via the MAT2-process management handbook)
6. Method Improvement (via continuous process improvement activities).

Example 1- QFD – Quality function deployment

Although QFD methodology is uncommon in the academic world‡‡, it has valuable applications in an industry (customer)-driven content development process. As a tool for structured product planning and development, it enables a customer to specify (clearly) their wants and needs and then to evaluate each proposed product systematically in terms of its impact in meeting those needs (COH,1995). The initial question of academic application, however, must address the unfamiliarity and acceptance of such methods. Within the MAT2 system, whose purpose is to provide a globally competitive workforce to industry, the QFD method was used to identify and reflect the needs and priorities of the customer (e.g. industry). Therefore, the transfer and adaptation of QFD methodology was designed and discussed with employers and academic providers in order to ensure its successful multi-stakeholder function.

Once they had identified the required skills and skill groupings, the Industry partners were asked to, in consensus, rank the groupings with the QFD method. This ranking of importance (1, 3, and 9) was used to complete an educational specifications roadmap and inform the prioritization and development of learning outcomes and performance-based objectives. Likewise, academic providers were asked to use the QFD-method and ranking function to identify the extent/ degree to which they are able to fulfill the industry specifications. As a result of this gap analysis process, the academic providers could provide a transparent current state analysis and engage in discussions about needed content development in the context of a customer-supplier relationship.

†† For the transfer of professional project management please see (BHC 2013)
‡‡ As described by Talib and Maguad (TAM, 2011), TQM and QFD can be used to identify the student’s wants and needs.
Figure 4 Transfer of industry methods into the development of academic products (dual education associates degree)

Example 2 - ECM – Engineering Change Management (ECM)

Traditionally considered as the ability to manage engineering changes (ECs) efficiently, Engineering Change Management reflects the overall agility of an enterprise. As part of the configuration management (CM), it includes the functional and institutional process to identify, manage, track and document the changes of a project configuration to improve and perfect the outcomes through the product life cycle (TAD, 2005). Described in section three, the complex MAT2 organizational architecture utilizes an adapted ECM system to enable organizational agility via change-driven transparency. Although CM and ECM are not common in the academic world, all stakeholders agreed that changes must be tracked and that configurations within MAT2 should be operationally defined. Such configurations would need to consider the overlaying system configuration (e.g., system organization, standard processes, contracts, reporting, etc.) as well as the specific program configurations (e.g., program content, schedules, standard tests, etc.). Therefore, once the configurations were defined, hybrid ECM (Educational Change Management) processes were established at both levels. Improvements can be identified through the established communication and reporting network, which allows each stakeholder to act as a change agent escalate configuration change decisions to the change control boards (i.e., system and program steering committees).

Example 3 - BCM – Business Case Management

In the context of this paper, Business Cases would be described as business situations where the professional analysis of the problem, including the objectives and options to address it, identify a positive, sustainable cost/benefit ratio. Business Case (BC) Management, therefore, is the planning, organizing, monitoring and control of all
aspects in a defined and released Business Case to achieve the BC objectives safely and in within the agreed-to time, cost and performance criteria.44

The application of BC analysis and BCM in MAT2 needed to consider the different stakeholders, so the proposed solution integrated their unique BC perspectives. An initial program-specific BC-Analysis was necessary to identify if a program should be developed, as it defined BC decision parameters and provided a clear understanding about the potential program success. Success criteria was measured regionally, and included current and projected industry demand, potential willingness and ability of academic providers, potential industry partners (willing to hire students), as well as available and/or needed program content and equipment. Methods for collecting the necessary data to inform the defined success criteria and conduct the BC program analysis included surveys, market research and cost/benefit analysis. The next level of integrated BC-analysis focused on the individual stakeholders, rather than program. The stakeholders and their unique BC considerations were as follows:

- Academic Providers: capacity vs. profitably (e.g. the minimum number of students necessary for a cohort to launch, sustain, and/or generate profit for the college)
- Industry partners: monetary and human resource participation costs (e.g. allocated human resources for development, instruction and management, required tuition, school stipend and hourly wage per student) vs. the value-added and cost savings (e.g. students’ production value, recruitment/training/turnover costs)
- Government: long-term sustainability and funding vs. economic and talent growth (e.g. funding necessary to create state-wide dual education system that meets the BC needs of a state economy, and is increasingly run by industry and colleges).

Such BC and BCM elements were incorporated in the program reporting so as to ensure fidelity to each program’s business case.

6. Stakeholder Management and Human factors

The above described scientific results from neuroscience regarding human factors and the concluded transfer recommendations into the “real industry world” were also considered within our project. Some relevant examples:

- **Individual Motivation**

  The human principles and mechanisms of incentives and rewards the individual settings, situations and expectations to the program have been analyzed carefully for every stakeholder. Stakeholder specific decisions criteria have been defined to identify aspects which would (de-)motivate the specific stakeholder. Equipped with this “motivational landscape” possible conflicts or win/loose situations between the stakeholders we were able to identify. The outcomes have been discussed very openly between the different stakeholders which created an atmosphere of awareness, understanding and fairness between the partners.

  Especially situations where contract designs between the partners were drafted such open minded discussion have been very helpful to plumb out compromises and to keep the motivation on a high level for each stakeholder.

  Also addressed were situations where global acting companies who were interested in a global metric were challenged to negotiate with companies who did not share that interest. In working through the outcome solutions it was important to find ways to move forward without losing motivation to remain involved with MAT2.

- **Intercultural aspects**

  With the involvement of US-American companies and MI-subsidiaries of German based companies the project setting of MAT2 had also the human factor of intercultural aspects. As described in (WGB, 2014) intercultural

44 According to IPMA-ICB definition for Project Management
differences regarding interpretation, approaches, communication and leadership have been identified and discussed openly to create common rules of acting.

- **Partnership**

  To partner is finally a decision of each member based on a careful analysis of the outcomes (rewards) with consideration of other options (e.g. not to partner, partner with a different party). This decision follows the human decision mechanism and is therefore strongly correlated to human factors like motivation (to partner). In our project the partnership principles were identified as a “KEY SUCCESS FACTOR”. This issue was addressed early and carefully revised, where necessary, to ensure partners’ motivation to remain in the project. Every partner accepted and had to follow crucial elements like “equal play” between colleges or industry partners, acceptance of agreed standards, the definition of “no-single-ownership- principles”, the common agreement to accountability principles (e.g. How to act if a partner is violating the agreed to standards) have been very helpful to create and maintain the partnership.

- **Fairness and Trust**

  Fairness and, in consequence, the creation of trust is crucial to manage such programs with so many different stakeholders and their expectations. Especially the existence if the individual human reward “history” (how fair somebody was treated) the fairness expectation are individual. In our case basic fairness principles (equal play, equal pay, open communication, accountability, no alliances with the group,) were identified, discussed and established.

7. **Learnings and open questions**

   In creating a new educational paradigm of competency-based apprenticeship training within a diverse stakeholder environment, a unique complex project dynamic emerges, requiring both the understanding and application of systems engineering and agile management methods. The MAT² case study represents the potential for such a project to transfer industry tools and methods to academia, and provides initial lessons learned for similar initiatives.

   1. With matured (complex) project management focused to each stakeholder’s unique interests, successful transfer of industry methods is possible in the academic world.
   2. Transfer success is dependent on the *intra* and *inter* stakeholder environment, so strategic partner selection should be considered.
   3. Systems thinking and applications are critical in achieving a paradigm shift in technical and/or apprenticeship training.

   With these learning’s, the authors pose the following open question: to what extent do the academic and industry stakeholders see value in their evolved contributing roles, and therefore, continue to expand their partnerships in the future? The answer to this question carries significant practical implications to the design, execution, and longevity of training programs, and should be considered regionally.

8. **Outlook**

   The culture of education is continuously evolving to meet the needs of external customers, both student and employer. MAT² is provides positive feedbacks in this regard, but is only the precipice of an industry-education partnership paradigm. With preliminary success and stakeholder acceptance, expansion of the MAT² system and programs is inevitable, and is currently evaluating to new community colleges across multiple state regions. With this outlook, it is critical that subculture of continuous improvement, focused to maintaining quality and relevance, be embraced.
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