FINAL REPORT

Report on Consultations with Madan Bhandari University of Science and Technology (MBUST) Development Board (DB) about Establishing a New World Class University in Nepal
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I - Introduction and Background. At the request of Professor Rajendra Dhoj Joshi, Chair of the MBUST Development Board, and with support from the Asian Development Bank, the author undertook a modest consulting project to engage in helping envision how best to achieve the aspirations of the MBUST DB for establishing a world class university whose primary purpose is to contribute to the improvement of economic development for the nation. After several one-on-one conversations with Professor Joshi, and a two-hour presentation to a group of engineering faculty members and practicing engineers from across Nepal (December 11, 2020), the author participated in four two-hour consultations with Prof. Joshi and members of the MBUST DB together with consultants to learn in more detail about the context, aspirations and resources available to support the project, and to share orally the author's relevant experiences and advice on how to respond. These conversations were guided in part by a list of 20 specific questions supplied by Professor Joshi which are included in an appendix to this report. The resulting eight hours of conversations were recorded and retained by Prof. Joshi, and they form a supplemental resource for future reference and guidance of the project.

II - MBUST Legislative Bill. The government of Nepal has tabled a Bill for establishing MBUST at the Parliament and established a Development Board with the authority to proceed with planning this unique new institution. The new university is envisioned with two important features that are unique within Nepal to set it apart from other universities. First, the governance structure of MBUST is specifically defined to provide a greater degree of independence from the government in selecting membership and in conducting oversight of the university, including the selection of faculty and administrative officers. In addition, the university is envisioned as a "world class" research institution, implicitly intended to become the flagship academic institution in the nation for research and teaching in science and technology. The motivating aspiration for MBUST is to become a catalyst for significant economic development for the nation.

These legislative achievements and high aspirations are a strong indication of the willingness of the government to set MBUST apart and provide it with unprecedented independence. These are essential prerequisites for establishing a globally respected and influential institution with the powerful mission of catalyzing economic development across the nation and should help enormously in providing credibility and recognition for the founders. Ideally, the government

would also provide adequate financial support for the first few years to reduce the risk to the founding faculty, students, and private financial investors in the project[1].

III - Mission and Purpose of MBUST. The aspiration to establish a game-changing new "world class" university in Nepal is not only exciting, it is also inspirational. The importance of starting with an inspirational mission cannot be overstated, because it is helpful in attracting the best and brightest talent to the challenge of starting from a blank sheet of paper and creating an important new institution. Furthermore, the additional purpose of establishing a new institution to catalyze the development of a robust economy for the nation makes this project one that is worthy of the rest of the career for those who are drawn to the challenge. In my experience, new institutions with high ambition and worthy purpose have the best chance of attracting the "right people" to succeed.

It is important at this point to suggest some clarification about the current mission and purpose of MBUST. Perhaps it is possible to explain what is meant by a "world class" institution in order to better address the national need for economic development in Nepal. It is doubtful that you expect to compete with universities like Harvard, Stanford, Cambridge, or Berkeley for Nobel Prizes in basic research in the sciences or literature. Instead, you may realistically hope that MBUST will quickly establish itself as the most respected and influential academic institution in Nepal and also become a fountainhead of technological invention and commercialization. Rather than aiming to produce a new Albert Einstein or Isaac Newton, MBUST might instead aim to produce a new generation of entrepreneurs such as the equivalent of a Nepali Bill Gates, Steve Jobs, or Mark Zuckerberg. Such a clarification would have major implications for the type of faculty, students, and trustees you plan to attract, and the curriculum you will develop.

Further along this path, it might be instructive to explore another new university that started with modest resources in an agricultural nation: Earth University in Costa Rica. The founding president of this university, President Emeritus Jose Zaglul, created an institution that is widely respected and regarded as exceptional in its economic impact in the region—and in its record of changing lives. Earth University has a focus on project-based learning in agriculture, entrepreneurship and sustainable development, and in character formation and leadership among its graduates.

IV - Institutional Development of MBUST: Financial Issues. The author was the first employee of a new college of engineering in the US devoted to creating a new paradigm for the education of engineers. When he arrived, the college had no buildings, funding, faculty or staff, students, or curriculum. The college upon his first arrival was just an idea with a pledge of financial support from a private foundation. In fact, the college consisted of five people: the four directors of the F.W. Olin Foundation and the author.

Studies of the financial expenditures of other benchmark engineering colleges in the US provided some expectations on what it might cost to finance the construction and establishment

[1] Some other nations with limited financial resources and high aspirations for founding a similar technical university have found alternative methods for providing special governmental support. For example, South Korea, in supporting an initiative to elevate the Korean Advanced Institute of Science and Technology (KAIST) to elite status, passed a bill enabling the best Korean students to fulfill their universal military obligations by attending KAIST and completing their PhD studies there rather going abroad for graduate study (personal communication, President Emeritus Nam Suh). This signaled to all citizens in the nation that KAIST is regarded as the most important university in the nation for creating new science and technology relevant to the economy.

of the college, and to sustain it through revenues generated from three primary sources: (1) endowment spending; (2) tuition, room and board; and (3) gifts and donations from private supporters. While these financial comparisons were helpful, they were found to significantly under-estimate the true costs for the project.

This is likely to be true for the creation of most if not all new academic institutions for the following reasons. The operating costs and budgets obtained from comparison colleges are based on the expenses needed to sustain a curriculum that has evolved gradually over many years. They do not include the cost of experimenting with new approaches and inventing completely new methods of teaching and learning. Instead, they are based largely on a rather traditional paradigm for teaching that uses lectures, laboratories, textbooks, homework problems, and exams for nearly all instruction. Furthermore, the comparative expenditure estimates have been optimized for efficiency within the local institutional context for many years.

But when starting a new academic institution with a mission to create a new paradigm of learning and marked with exceptional quality and influence, the costs required to take advantage of this rare and important opportunity to innovate are certain to be more expensive and inefficient. Anyone who has taught a traditional lecture course for the first time knows that it is substantially more time consuming and difficult to offer the course the first time than it is for the third, fourth, or fifth time. A similar principle applies to the establishment of an entire academic institution. As a rough estimate, it may be wise to estimate the actual costs per student in the first few years as two or three times the costs per student for steady-state operation of a well-established and mature comparative institution.

IV.a - Costs of project-based instruction versus lecture-based instruction. Since the establishment of project-based instruction is a specific goal of MBUST, it is important to explore whether this mode of instruction might present prohibitive instructional costs. To provide some guidance on this, Olin College of Engineering, which offers one of the most project-intensive learning models for engineering in the world, has a current curriculum where about one-fourth to one-half of all instruction involves students working in teams on a project. The average engineering student who graduates from Olin College has completed more than 20 team-based engineering design projects. Yet the expenditures per student today at Olin college based on the total annual operating expenditures divided by the total undergraduate student enrollment are comparable to those at elite undergraduate engineering colleges in the US with a more traditional curriculum. (Olin's costs per student also include the costs of continuous experimentation to support our unique mission to continually change and improve everything about the learning experience, and therefore are certain to be more expensive than other institutions that are intensively project-based in instruction.)[2]

IV.b - Raising endowment funds. Endowment funds are regarded as highly desirable because they do not depend on the unpredictable changes in government support or the market competition for tuition revenue. Instead, they are derived from the investment in long-term financial instruments (stocks, bonds, etc.) of the generous gifts of donors and friends of the

[2] Professor Lori Breslow at MIT previously served as Director of the MIT Teaching and Learning Lab. She reported that her experience there provided evidence that to switch from lecture-based to project-based instruction required an up-front investment in faculty workshops to learn the new methods. But after this limited initial period of faculty development, the costs to teach in the project-based learning mode in the steady-state were comparable to those required for more traditional lecture-based instruction. In addition, Professor Vincent Manno, Provost Emeritus of Olin College, could provide additional guidance and independent advice on this point.

university. But generally only bout 4 – 5% of the total value of the endowment may be spent each year in order to preserve the permanent purchasing power of the endowment fund. In addition, endowment funds that are not restricted in use allow extremely valuable financial freedom in addressing the greatest challenges and opportunities in the development of the institution.

However, raising funds for an endowment is notoriously difficult, especially for a start-up university, because most large endowment gifts are from grateful alumni. For the first 30+ years, the alumni of any new university are unlikely to be in a financial position to make large gifts or be interested in leaving a legacy with their philanthropy. During this start-up phase, perhaps the most strategic investment of time and effort with the goal of raising funds is to do whatever is possible to establish the reputation of the institution for excellence and impact. In other words, make every effort to make MBUST stand out from other institutions in ways that will make the government, the public, and the business community proud of the institution. MBUST must matter to the country. Donors are very unlikely to make significant investments in institutions that don't matter.

In the US, where endowments play a larger role than in many other countries, the vast majority of academic institutions have extremely small endowments. There are more than 4,000 colleges and universities in the US, most of them are 2-year community colleges or 4-year undergraduate state-supported institutions. Very few of them have significant endowment funds. Among the most successful and well-established private research universities, the endowment does play a significant role in supporting the operation of the institution. For example, Olin College derives about 50% of its operating expenses from endowment spending, which is among the highest percentages in the US. Olin College is among a very small number of private institutions in the US whose endowment is valued at more than $1 million USD per enrolled student. It is not uncommon for other well-known institutions (e.g., private world class institutions) to derive between 25 and 50% of their operating expenses from endowment spending. However, it is very unlikely to find a capable and willing donor with the many millions of US dollars necessary to provide an unrestricted endowment large enough to provide this level of operating support.

In addition, the endowment funds of most universities have been restricted in use by the donor for specific expenditures that the donor is interested in supporting. For example, the funds may be restricted for tuition scholarships for needy students. Or they may be restricted for support of books in the library, or support of a faculty professorship devoted to a specific research area, like biomedical engineering, etc. The point is that the real needs of the university (building repairs, unexpected electric power utility increases, increase in health insurance due to COVID, etc.) are frequently excluded from the potential uses of the endowment funds.

The uncertainty of financial resources in the start-up phase of a new university is certain to seriously reduce the ability of the university to attract the right people, experiment and innovate with important new approaches to research and teaching, to build facilities that are attractive and suitable for the mission, and attract the high-quality students needed to provide for success. Ideally, the government—or a very wealthy and philanthropic donor—will provide assurance of operating expenses for the first 3 – 5 years to make sure MBUST does not fail immediately for lack of financial support.

IV.c - Budgeting in a start-up environment. Fiscal responsibility and management is very important in all institutions, but especially in a start-up environment. This is true for several reasons. For example, in a start-up institution, ALL of the members of the institution are new in

their respective positions. This includes the President and the Board of Trustees, but also the Chief Financial Officer, Deans, faculty, administrative support team, etc. In the first year, one of the most visible and important metrics for establishing trust is the management of financial resources.

However, in the first year of operation, it is nearly impossible to provide an accurate and responsible budget that allows for experimentation and investment in quality. This is because there is no previous data to rely upon to determine what it cost last year for any specific activity. In fact, in the first year, the leadership will face many unpredictable issues and unknowns that prevent the development of an accurate budget that allows for assurance of quality.

In the first years of Olin College, when expectations for quality and impact were highest and our experience and data was nil, what happened was many department managers under-spent the budget they requested at the beginning of the year—by approximately 30%. This is because they were extra cautious to not over-spend in order to preserve trust with the Board of Trustees, and because they independently created contingency funds to guard against uncertainties and risks that were beyond their control. We discovered this at the end of the budget year and resolved to build future budgets with minimal departmental contingencies, so all risk management would have to be done in the President's Cabinet meeting as a group. This reduced the duplication of expenses that is a natural consequence of departmentalization and after a few years helped greatly to reduce the unspent contingency at the end of the budget year.[3]

V - Institutional Development of MBUST: Personnel Issues. It takes many components to establish any successful university. For example, it takes facilities, curriculum, students, faculty, administrators, policies and procedures, financial support, governance, public relations and communications, etc. But the most important component by far is the people, including the faculty and students, leadership and administration, staff, and the members of the Board of Trustees. World class universities are fundamentally a self-contained community of world class people. In fact, the author believes you could imagine that the purpose of all the other components is to attract and retain the world class people that breathe life into the institution. If you have superb buildings and strong financial support, but do not have exceptionally talented and motivated people, it will never become a world class institution. Most existing universities today fit this description. On the other hand, if you manage to attract world class people from the start, you will have a good chance of obtaining the other components to support these people and thereby establish a truly world class university.

Just as important as attracting people with exceptional talent and motivation is the establishment of a culture that promotes excellence and innovation. This culture establishes a set of strongly held community values that start with honesty, integrity, trust, and a commitment to find the truth no matter where it leads. Above all, higher education is about finding truth, testing truth, and disseminating truth for the betterment of humankind. This can only happen if there is a commitment to academic freedom. Academic freedom enables every member of the community to pursue the truth without fear of persecution if the truth exposes inconvenient facts

[3] Mr. Stephen Hannabury, Executive Vice President Emeritus of Olin College, was the chief financial officer for Olin College through is first 20 years and would be an excellent consultant on the financial and administrative aspects of creating a new institution like MBUST. He is nationally recognized for his expertise and innovation by the National Association of College and University Business Officers in the US, where he was selected as the Business Officer of the Year in the US in 2017. I would be glad to introduce you to Steve if this would be of interest.

that might embarrass someone in authority. Only if the community fully trusts the institutional commitment to truth and academic freedom will world class faculty and students choose to locate at the new university. Also, since the discovery of truth rarely follows a predictable pattern and accidental discoveries have played a critical role in the advancement of science (e.g., the discovery of penicillin, etc.), the freedom of faculty and students to explore curiosity-driven interests is also an important part of academic freedom. This means that strategic plans, as well-intended as they are and as important as they are, should not prevent the freedom to explore unanticipated discoveries, and leadership and governance should not be heavy-handed in directing the efforts of faculty and students in their research work.

Finally, if the new institution is to be marked by success in innovation and change, the culture must encourage experimentation. Experimentation usually results in frequent disappointment or failure as the researchers learn through trial and error—and often accidental discovery—how a system really works.[4] As a result, the culture should be perceived by faculty and students as one of "kindness" where tolerance and acceptance of disappointment in the pursuit of new ideas is regarded as normal and acceptable, rather than intolerable. Framing this discovery process as an iterative refinement of our understanding, rather than a failure to succeed, provides the foundation for vibrant and bold experimentation. Faculty who take a risk and embark on a bold experiment that fails should not be subjected to public humiliation or shame. If this happens at the beginning, faculty will quickly learn that what is expected is to avoid risk of failure and instead undertake only small research projects whose results are almost certain to succeed every time.

Let me end this section by emphasizing the importance of trust and core values. It is well understood now that the most important discoveries now frequently come from the intersection of disciplines on the edges of tradition, rather in the center of traditional disciplines. Fields like biological engineering, artificial intelligence and human behavior, and molecular genetics are examples of emerging research that fundamentally require collaboration and teamwork of faculty across disciplines. Teamwork is made possible by a foundation of core values. It is important to construct the core values of MBUST before the founding faculty are recruited.

At Olin College of Engineering, the author established five core values before anyone of the Vice Presidents or faculty members was recruited. The core values at Olin College are as follows:

> **OLIN COLLEGE CORE PERSONAL VALUES**
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> **Integrity.** Complete honesty is expected from everyone in every situation. Even the appearance of conflict of interest will be avoided. Successful long-term relationships depend on trust and open communication.
>
> **Respect for Others.** Each person is treated with respect and dignity in all situations. Criticize only ideas—not people and share responsibility. There is no room for abusive language or arrogance in relationships with others.

[4] The Wright Brothers, a pair of bicycle mechanics in Ohio in the US invented the aircraft industry, rather than physicists working in a university research laboratory. The process they used is one of bold experimentation, where they repeatedly jumped off a mountain with primitive wings on their back, routinely failing to achieve flight. But each time, they learned something new, and realized there must be a better way. This led to a new experiment with some modest changes to the wings, and over time, through this process of iteration, their understanding grew until several years later, they invented a successful flying machine.

Passion for the Welfare of the College. Each person will adopt the perspective of the Trustees and passionately pursue the overall interests of the College, while maintaining fairness to all individuals in all transactions. Personal advancement at the expense of others is discouraged and cooperation is expected.

Patience and Understanding. Each person will listen constructively, keep an open mind, and take the time to understand with empathy before reaching a conclusion. Effective teamwork depends on the confidence that others care and are willing to take the time to listen.

Openness to Change. Continuous improvement requires openness to change, even though this usually causes inconvenience, inefficiency, and risk of failure. Olin College will constantly strive to innovate and improve in every area.

These core values are taken seriously at Olin College and assessed as part of the 360 evaluations of the leadership team. In the beginning, Olin hired an external consultant (organizational psychologist) to assess how well we did at embracing these core values throughout the institution. We found that the last value, openness to change, was the hardest one for our community to maintain.

It is also noteworthy that the students at Olin decided to use these five core values as the basis for their student "honor code" by which they hold each other accountable for behavior in the community. They add one additional core value, and that is the "do something" clause. It requires any member of the community who sees someone else violate one of the core values to confront the individual personally and request that they stop the behavior. If the offender persists after this intervention, each student is required to report it to the student run Honor Board for investigation and adjudication.

V.a – Who are the "right people," and who starts the process of assembling them?
Finding the right people, especially at the beginning, is a critical task, perhaps the most important task. There is an important sequence in assembling the community, and the process of finding them is very important.

At the heart of the institution is excellence, discovery, and building student (and colleague) success. Since important discoveries rarely occur to an "unprepared" mind, and since teachers can only teach what they know, it is obviously important to assemble a community of very knowledgeable and academically accomplished people. The most common signal of academic achievement is formal graduate training, such as obtaining the Ph.D. degree from a world class university. So, a natural place to start is with graduates of highly respected universities in science and technology. This should provide a rich candidate pool of knowledgeable and accomplished people. However, this quality of the faculty is the easiest to obtain and assess.

Also, to maximize the mutual trust and teamwork between the founding faculty and administration, ideally the first academic to be recruited should be the president. This assures that the president has personally chosen the team she or he will trust with the invention of the research and teaching mission of the institution and can form a supportive bond with them. Personalities and values matter a great deal in any institution, but particularly in a start-up environment where it is routinely expected that everyone will work far harder and longer hours than in any well-established institution. Ideally, the Board of Trustees will select the President, and then the President will select the Vice Presidents, including the Provost or Chief Academic Officer. This small leadership team will then work closely with each other to build the structures and procedures that enable the institution to begin functioning. The start-up environment is

certain to feel overwhelming in the first year or two, much like flying an airplane as it is being built.[5]

In addition to exceptional knowledge and academic achievement, the attitudes, behaviors and beliefs of the founding team of faculty, staff and students is equally important. There is no place for arrogance and ego, hierarchy of decision-making, and a lack of openness to change. Only when the founding team is willing to accept and seriously explore ideas and suggestions from the most inexperienced and junior people on the team does the institution have the capacity to challenge assumptions and create new learning pathways.[6] Extensive personal interviews by a wide array of members of the community are perhaps the best way to get to know the values and motivations of candidates for employment and study. This takes more than one day for interviews, to insure that a candidate is unable to hide her or his true feelings throughout the duration of exposure to the community. Sooner or later, they are likely to reveal their true feelings and biases, which is of primary importance. And before offering employment, the comments of everyone who has interacted with the candidate, often including food service staff or real estate agents off campus, are taken into account. Ideally, those people who form the founding faculty and leadership team are not seeking power or authority, or even a prestigious position. They will describe the college as a "cause" and their role as a "calling" as if in religious terms. We call this "intrinsic motivation."

Selecting the leadership team follows similar principles. The "right" people for leadership rarely seek an appointment for the purpose of exercising their personal authority or power, or even to become the decision-maker whose final decisions will set the course for others. Instead, they are people who are more impressed with the great responsibility they carry to the others on the team and in the nation, as the grand experiment of creating an innovative and influential new institution weighs heavily on their shoulders.

While the process for selecting Trustees may be beyond the purview of the campus community, ideally similar principles will dominate the selection process. They will not only be successful and respected from a broad array of backgrounds (academic, business, government, arts and humanities, etc.) but they will also be gender balanced and represent the cultural values of the country of Nepal. The primary job of governance is to select the president and participate in setting the goals and strategic decisions of the institution. Good governance does not make management decisions but judges the judgement of the president and the leadership, and when the institution consistently fails to meet expectations, governance must take responsibility for changing the president. Governance in a non-profit institution is very different than that in a for-profit corporation.

V.b – How are faculty evaluated and assessed? It is often stated that you get what you measure. The expectations and criteria for assessment of the faculty (and also students and

[5] This humorous short video about flying an airplane while it is being built was used frequently at Olin to explain what it was like to live and work at the institution in its early days. It was created by an advertising firm in Silicon Valley because it resonates so deeply with the culture of start-up technology firms. Note that the crew work under extraordinary risk and inconvenience every day, but so do the passengers who take a risk on flying in an unfinished airplane. They are all passionate about their work and love their jobs.

[6] It is important to remember that Isaac Newton was in his early twenties when he invented the theory of gravitation and the calculus, which was upsetting to his colleagues at Cambridge at the time. Likewise, Bill Gates, Steve Jobs, and Mark Zuckerberg were also in their twenties—and failed to graduate from college—when they invented three of the most successful and powerful technology companies on the planet.

administration, etc.) must reflect the true values and priorities of the institution. The traditional approach of measuring mostly the production of reviewed journal articles and student evaluations of teaching is likely to eventually result in a campus culture that matches most other universities and does not lead to world class performance. If MBUST hopes to become the pathfinder for new levels of academic achievement and innovation in Nepal, it should consider rethinking the criteria for assessing faculty and others at MBUST.

After several years at Olin College of Engineering, we discovered that our quite traditional original criteria had to be completely rethought and rewritten. The result is unique to Olin, but might be of some value to MBUST, also. It replaces "research" with "nationally visible intellectual achievement" (which, of course, also includes published research, but is much broader). It replaces "teaching" with "building student success." And it replaces "service" with "building institutional success."[7]

VI - Institutional Development of MBUST: Academic Issues. Once the right people have been assembled and the new institution is focused on the central challenge of discovery and learning, a number of critical academic issues take center stage. Above all, it is of primary importance to focus on the mission and purpose of MBUST as the new model for academic excellence and economic development in Nepal. There is a reason why world class institutions are rare, and to make the most of this exceptional opportunity to start from a blank sheet and create, it would be a tragic mistake to attempt to copy the program at another institution—even a very good institution. Note that the MIT Open Courseware program provides detailed course syllabi, homework exercises and exams for nearly every field and course offered at MIT—at NO COST. If creating an authentic MIT learning experience were as simple as copying these course structures and materials from the website and implementing them at another institution, then there would be many other institutions equal in stature to MIT in science and engineering research and education. But the fact is that copying these materials does not duplicate the learning experience and does not produce equivalent results.

Instead, MBUST would be well advised to first establish clear principles and goals for what the MBUST educational experience will achieve that is different from other institutions.[8] For example, MBUST might declare that it will prepare graduates to BE engineers, rather than prepare students who will LEARN ABOUT engineering. Similarly, they may prepare graduates who are successful researchers in subjects relevant to Nepal, rather than prepare graduates who have studied basic sciences and written one thesis. Finally, they might prepare graduates who are successful entrepreneurs who have started an enterprise while still in school, rather than preparing graduates who have learned something about entrepreneurship by taking a few courses.[9] These decisions would have profound consequences for the structure of the university, nature of the experiential learning that is implied here, the capabilities of the faculty, and the type of course experiences that are required to deliver such an education.

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[7] More information on this new criteria which has been very successful at Olin College may be obtained with follow-up conversations with Professor Vincent Manno.

[8] When Olin College was at this stage, the founding faculty met continuously about these goals for several weeks and collectively reached consensus on a set of eight Bold Goals. These short statements set expectations for what the learning experience was intended to achieve. We assumed from the start that the learning experience would be fundamentally different from that at other more traditional institutions. So, we developed the discipline of searching for WODTODs, or **W**hat **O**lin **D**oes **T**hat **O**thers **D**on't. This was a prerequisite to inventing the structure of the degree programs.

[9] Earth University produces graduates who have significant experience in starting new agricultural ventures based on the principles of entrepreneurship.

To illustrate this process, a central theme in Olin's learning experience is to prepare our graduates to **BE** engineers, rather than to **LEARN ABOUT** engineering. To be an engineer requires that you have significant repeated experience in conceiving, designing, implementing, and operating complex systems to meet human needs.[10] These systems always involve multiple disciplines, revolve around the needs of a client group, require design under constraints that not only include feasibility from natural laws but also budget and schedule constraints, and require teamwork, effective client relations, and proficiency in project management. As a result, Olin's current engineering curricula in all three majors (mechanical engineering, electrical and computer engineering, and a more generic option just labeled "engineering") require students to complete more than 20 design projects, most of them in a team format, all of them requiring interdisciplinary cooperation and trade-offs, and using the principles of human-centered design from Design Thinking, as developed at the *d.school* at Stanford University (and elsewhere). To complete the program, most students work on a SCOPE capstone design project that involves a corporate sponsor for two semesters in the senior year. The corporate sponsors are significantly invested in the project by paying Olin College $55,000 USD for the privilege of working with 4 – 6 undergraduate Olin engineering students for part of their two-semester senior year program. This capstone project teaches them to BE an engineer in a real and complex project with a sophisticated paying client. By the time the student teams undertake the SCOPE capstone, they have already successfully completed about 20 other smaller projects throughout the previous three years and have learned through experience how to manage complex projects. As a result, it is common for SCOPE projects to involve non-disclosure agreements for the sponsoring corporation, and the invention of new patents and new products. It is also common for Olin students after the first, second, and third years to spend the summer period as a paid intern in a technology corporation, gaining further experience in applying the principles of engineering in a corporate setting. Many times students who complete a SCOPE project receive an offer of employment from the corporate sponsor.

Having established this vision for what the Olin learning experience must include at its heart, the rest of the curricular experience can then be built around this centerpiece. For example, the supporting sciences and mathematics can often be taught in an interdisciplinary team format, where faculty team-teach the material and students stand and deliver their project results in front of the entire class at the end of each semester.

To deliver a learning experience like this, the faculty must be comfortable teaching in a team format with material that is interdisciplinary. This requires a deliberate program of "onboarding" or training new faculty members to become successful teachers and engineers in this design-based pedagogy themselves.

VI.a – Organization of faculty. Finally, the structure of the institution itself should be designed to support the learning model at the heart of the institution. At Olin College, our faculty are not organized in academic departments by the disciplinary research background of the faculty. Instead, we have no academic departments and organize the faculty as a single heterogeneous community. The faculty includes many engineers, natural scientists and mathematicians. But it also includes social scientists, humanists and artists, too. When the faculty meets each week, the only thing that they all have in common is a concern for learning experience of the students.

[10] At Olin, an engineer is a person who envisions what has never been, and then does whatever it takes to make a better world. The important thing here is that it begins with vision, not with mathematics, and it implies resourcefulness and a deep motivation to improve the lives of society.

This deliberate multidisciplinary organization of the faculty has many beneficial consequences. It fundamentally changes the nature of the institution, and the conversation among faculty members. One simple metric at any university that may provide insight into the depth of interdisciplinary interaction is who each faculty member has lunch with each day. If they eat only with other engineers in their same academic discipline, the conversation they have will likely be limited by the common disciplinary background that they share, and therefore will miss the insight needed to conceive and pursue more complex societal issues that span many disciplines.

It has been common for many years that engineers in the most innovative corporations are no longer organized by the academic discipline they studied in college. Instead, they are immediately organized in teams intended to support the creation of a specific product. For example, at an automobile company like Ford, engineers are assigned to multidisciplinary teams to design a particular vehicle from beginning to end. The team might include mechanical and electrical engineers, but it also includes machinists from the factory floor, marketing and distribution staff, financial analysists, and even client representatives who are customers. The ability to work productively in teams has long been a request from engineering employers to engineering colleges.

Olin is not unique in organizing its engineering faculty in ways that are not focused on traditional academic disciplines. For example, Arizona State University, a very large public institution, has developed many innovative multidisciplinary communities of scholars who work as a team to address complex contemporary societal challenges. Some years ago, ASU restructured all of the academic departments in the College of Engineering into problem-focused areas aimed at the Grand Challenges of the 21st Century. Their current engineering departments include: School of Computing, Informatics and Decision Systems Engineering; School of Electrical, Computer and Energy Engineering; School of Engineering of Matter, Transport and Energy; and the School of Sustainable Engineering and the Built Environment. That this new interdisciplinary structure of engineering research and teaching at ASU has achieved a degree of national respect might be inferred from the recent decision by the US National Science Foundation to appoint an engineer from the leadership of ASU to serve as the current Director of the National Science Foundation. Dr. Panchanathan was involved in restructuring several of the academic departments and research centers at ASU.

In addition, if creativity and innovation are intended to be central to the identity of the learning experience, then selecting founding faculty with these interdisciplinary and creative abilities is of central importance. For example, at Olin College one of our founding faculty members is Professor Diana Dabby. She is a professor of electrical engineering and music. (Olin doesn't offer degrees in music, but this is a description of who she is and what she does.) Professor Dabby began her career as a concert pianist. She has played piano solo at Carnegie Hall in New York, and taught part time at the Julliard School of Music. But at mid-career, she became concerned about electronic music, and against all odds, she returned to school to obtain a PhD in Electrical Engineering from MIT. Her PhD advisor with Professor Amar Bose, who founded the Bose Corporation, a prominent designer and developer of high quality electronic audio equipment. When Olin College found her, she was teaching circuit design in electrical engineering at MIT and simultaneously teaching music theory at Tufts University a few miles away. She told us she was afraid to mention that she is both an engineer and a musician for fear that her technical colleagues might not respect her work. We told her it is time to "come out of the closet" and demonstrate for all of us how "multiple intelligences" work. She has been an inspiration to many of us the way she develops independent insights informed by her dual perception of the world.

So, among the first tasks at MBUST after assembling the founding faculty is to work with them to develop the Bold Goals for the MBUST learning experience. Since MBUST plans to start with the MS and PhD degrees, these goals will need to be developed first. What will MBUST do in the graduate learning program that sets it apart from all others? What are the characteristics of the MBUST graduates that will set them apart in the marketplace? What are the characteristics of the faculty needed to invent and implement this new learning model at the graduate level?

VI.b Project and Design-based learning. Educational research consistently shows that learning occurs best when the learner is fully engaged in the learning process.[11] With this metric as a guide, it is possible to identify those learning approaches that are most successful at producing strong learning outcomes. For example, lecture-based learning, where an expert stands in the front of an auditorium and speaks continuously to a large class of passive learners seated in rows, as is typical today in higher education throughout the world, is rarely engaging for the learners. In general, when this approach is used today, students frequently choose not to attend the class, or if they do, they resort to checking their email or watching videos on the internet. The result is poor engagement with the material presented, and poor learning. The level of understanding and retention of knowledge is among the lowest for the average learner in the audience.

On the other hand, when lectures are organized in a more applied and problem-based format, the level of engagement can increase substantially. In this format, the classroom may still have an expert in the front and a large number of learners seated in rows, but the leader does not present material in a "just-in-case" monologue covering principles in the abstract. Instead, the material is re-organized in order to address a specific example in a real context. Then, instead of explaining everything in advance, the leader asks students to read the material ahead of class, and come prepared to propose ways in which the conflict or problem might be solved. As a result, the teacher calls on students to present their views, and then calls on other students with counter views, to foster a discussion or debate. Sometimes this is accomplished with a diverse panel of guests who are interviewed about the topics in class. A good example of this form of problem-based instruction is the course on Justice at Harvard University lead by Professor Michael Sandel. (The entire course is available at no charge online.)

Yet a higher level of learner engagement is provided by project-based pedagogy, in which the course material is further restructured to include a project requiring all learners to take an active part in creating a detailed solution or building a prototype of a solution for a specific problem or challenge and advocating for its adoption. The project might be a physical prototype of a device to solve a problem, or it may be to run an experiment to test a proposed solution in a social context. In project-based learning, the teacher prepares a possible solution and includes the relevant parts so the student can focus largely on assembling the prototype and testing it for functionality. This level of engagement is higher than discussing or debating a hypothetical answer to a problem as in problem-based learning and is likely to result in deeper understanding and enhanced retention of knowledge.

Perhaps the highest level of learning effectiveness is provided by design-based learning. In this method, the learners are usually assigned to small interdisciplinary teams and presented with a complex problem in context with real clients. After significant personal interviews with the clients to understand the problem from the perspective of the client, the learner teams are asked to envision an array of possible solutions (or devices) capable of improving the situation, and

[11] See, for example, Albert Bandura's Social Learning Theory and Benjamin Bloom's Two Sigma Problem.

then engaging with the clients to select the most promising one before attempting to build a prototype. This type of learning not only requires mastery of the content material for the course, but also exercises creativity to envision possible solutions, exercises ethics in considering what should and should not be done, requires judgement about practical trade-offs involved, develops communication and negotiation skills, and fosters management and leadership as the final project results are obtained. When a learner completes a project of this depth, understanding and retention of the lessons are maximized.

If MBUST aspires to world class learning, it should do its best to make decisions on pedagogy that maximize student engagement at each opportunity within the limitations of time and resources.

VII - Institutional Development of MBUST: A Culture of Experimentation. The mission of leading the nation in research and innovation requires special cultural values that set the institution apart. Research, or "finding things out," as Nobel Prize winning physicist Richard Feynman noted, requires curiosity and constant experimentation. The vast majority of new discoveries are the result of experimentation, not mere theoretical conjecture.

Engineers are distinct from scientists primarily in their motivations and purpose. Scientists ask "why" as they seek to understand the world, whereas engineers ask "why not" as they seek to change it. From Leonardo da Vinci to the Wright Brothers, engineers are prone to experiment often and learn primarily from experience in an effort to make a better world.

In order to instill this culture of discovery and adventure in the culture of a new university, it would be wise to take every opportunity to challenge the community to experiment with the important decisions before accepting them.

Let me illustrate how this might be done by explaining how the curriculum and learning culture of Olin College of Engineering was developed. When the author was chosen to become the first employee and president of the College, he had first written a "white paper" to the Chairman of the Board of Directors of the F.W. Olin Foundation who had solicited candidates to establish the school. This paper laid out the best thinking that the author had assembled after a quarter century of experience leading engineering research and teaching at three highly regarded research universities in the US. The purpose of the paper was to communicate to the selection committee the kinds of new approaches to engineering education that the author deemed worthy of consideration if he were chosen to lead the creation of the new institution.

The chairman of the presidential selection committee very much liked this paper, and subsequently required other candidates to submit a similar document. Soon thereafter the selection committee chose the author as the first president of Olin College.

The Board was anxious to recruit the founding leadership team and faculty and they set an aggressive schedule for welcoming the first students and teaching the first classes. With these high expectations and great pressure to open the college as soon as possible, the most expedient thing to do was to start with the white paper as the vision for the learning model and curriculum, and quickly recruit vice presidents and faculty who are charged to implement this vision.

But that is not what the author did. There were several concerns about this "efficient" approach. First, the type of faculty who would accept the assignment of simply implementing the decisions

of the president—invented by himself without consultation with them or with others—are unlikely to be creative and inventive themselves. In addition, the author's experience in teaching and research for 25 years had taught him that a teacher's passion for the subject is as important as his knowledge when inspiring learners to become scholars. And that passion is much higher if it comes from within as the result of a personal ownership of the ideas and the methods used in the curriculum.

So, the author hid the paper in a drawer and refused to show it to the faculty candidates. He challenged the founding faculty to propose their own consensus vision for the curriculum for his approval, with the mild threat that if it failed to exceed the quality of his white paper, he could always override the faculty recommendation later and use the vision presented in the white paper instead.

The author proposed a strategic process for inventing the curriculum, consisting of four steps: Discovery, Invention, Development, and Test. The Discovery phase required the founding faculty to visit (or host visits from) 30 different universities and 20 corporations to learn their vision for the future of engineering and education. The Invention phase involved sequestering a subset of the founding faculty in a hotel for a weekend with the task to propose a high-level vision for an integrated engineering curriculum that was fresh, incorporated the best ideas they had seen during the Discovery phase, integrated not only science and engineering principles, but also social science, humanities, arts, and entrepreneurship, and made use of the academic resources of neighboring institutions (Wellesley College, a famous women's liberal arts college, and Babson College, the most respected business entrepreneurship college in the US). The third phase involved developing the teaching projects and materials necessary to offer the courses in this completely new paradigm for engineering education. And the fourth phase, Test, required the founding faculty to take the time to test the new ideas and assumptions for a year with a group of 15 boys and 15 girls who were just 18 years of age and recent high school graduates. This year of testing the curricular ideas was, perhaps, the most important event in the history of the development of Olin College.

During the test year (called the Olin Partner Year at the College), the students were not taking courses and made no progress toward graduation. Instead, they were part of the curricular invention process, on a first name basis with the faculty and administration. About every five weeks, the student partners and the faculty would undertake a new project in order to test the validity of the assumptions and the limits of practicality of what can be accomplished with a group of young engineering students working independently. These tests could not have been conducted at Harvard or any university where students were taking courses for degree credit. Instead, the tests were designed to push the limits of what is possible toward failure, for the specific purpose of watching the failure to explore how students and faculty respond under extreme conditions.

For example, in one of our early meetings with the founding faculty, we asked the question of what you remember from your own undergraduate education. In general, everyone had at best a vague recollection of books and tests and some general principles from lecture courses. Very few faculty members felt confident that they could pass the exams if given to them today. However, there was one stunning exception. That exception was the capstone design project for those who were engineers. Most engineering faculty could remember amazing details of their senior project decades after completion. The retention of knowledge for this project was much higher than retention of knowledge for lecture courses. This sparked a conversation about why the project was always placed at the end of the four-year curriculum, and few if any projects were used in the first three years. We speculated that if the project was introduced too

early in the curriculum, the students would not know enough to succeed. (This is like assuming that a student couldn't be expected to pick up a hammer or a screwdriver to conduct their own experiments without first passing a course in theoretical physics and calculus!)

To test this hypothesis through experimentation, we assigned the 30 young students a challenge very soon after they arrived on campus. We asked them to design, build and demonstrate a "pulse oximeter," a medical instrument that measures the pulse rate and oxygen content in the blood of a patient. They had never heard of the device. We told them that this was not a test of their individual intelligence or ability and asked them to work together. In fact, we invited them to go off campus, talk to their parents or relatives who might work in a hospital, and ask questions of anyone who they thought could help. We suggested that they begin with the patent description available on the internet, because the inventor had to provide a simple schematic diagram for the device and provide a simple narrative of how the device works.

But in order to provide the opportunity to do many other experiments that year, we strictly limited the time allowed for this project to a maximum of five weeks. We felt that five weeks of intense focus on this one project would reveal what we needed to know about how they would respond when the expectations were very high and their preparation was nil. We viewed the experiment as equivalent to throwing the students in the deep end of a swimming pool and asking them to teach themselves how to swim to get to the side. We fully expected the students to fail to build a pulse oximeter.

However, we were wrong. Before the end of the five-week period, the students succeeded in building a working model of the pulse oximeter. We brought in a commercial version from a hospital and placed them side-by-side and observed the pulse diagram of both devices on an oscilloscope showing them performing in an identical way. We were shocked. We never would have believed this result if we had only read about it in a journal or heard a presentation about it at a conference. But we saw it with our own eyes. We had to believe it.

Then we were skeptical that there must be something deceptively simple about this particular project that is the reason why it worked. So, we tried similarly ambitious and challenging projects about every five weeks for the rest of the academic year. Every time the students exceeded our expectations, and every time they demonstrated their ability to work together and create the level of understanding needed to complete the project without the benefit of lectures or extensive theoretical explanations from the faculty. This experience taught us an enormous amount about what is possible in establishing a new culture of learning and about the power of teamwork in attacking complex problems.

That year the experimentation of the Olin Partner Year taught us that students are far more capable of independent learning that we think. The students also demonstrated for us that engineering is not a body of knowledge (although it obviously involves a lot of knowledge). Rather, **engineering is a process**, and the process involves multidisciplinary teamwork focused on building a prototype of a system that is intended to achieve a purpose. And these attempts at building prototypes rarely work on the first try. Reflecting on our own traditional engineering education, we realized that only a very small proportion of our own university education was focused on the process of engineering, revealing a glaring need and opportunity for correction.

The experiments also revealed something perhaps even more important. The effect of this type of team-based design learning had a noticeable effect on the students, too. They enjoyed it immensely, and they developed an internal confidence that working together, they could build

whatever they could imagine, and they could make a positive difference in the world. They had a "can do" attitude, a sense of self confidence in working with engineering principles and science. When we reflected back on our own learning experience at that age, we felt overwhelmingly that we did NOT achieve anything like this in our undergraduate education. Instead, in our first two years in traditional engineering education at top research universities, we felt incompetent and lost, worried constantly that we would fail. We saw no practical application for the science we were learning, and every year more and more of our student colleagues gave up and dropped out of engineering studies altogether. Some of our faculty described their undergraduate engineering experience as a "math science death march," a process of attrition.

This history recounts the powerful impact of the Olin Partner Year on our learning about engineering pedagogy, and about the deeper issues in student learning. The results may, in fact, be limited in some ways to the culture and environment at Olin College that year, and to the qualities and attitudes of the founding faculty and students we had. It is entirely possible that other institutions may not achieve the same results by copying this pedagogical approach. But this example clearly presents an existence proof that experiments of this kind can and do routinely exceed expectations and change the beliefs and understanding of faculty and academic leaders alike.

So, the author recommends that MBUST consider adapting the principles illustrated here in the Olin Partner Year to the process for creation of the curriculum in Nepal. The author is confident that by taking an extra year or even six months and experimenting with a small group of Nepali students prepared according to the existing high school curriculum and standards in Nepal and embracing them as partners in creation of your curriculum and pedagogy would be a wise investment. And to make sure that this experimentation at the beginning of the university is not limited to a one-time creation event, the author recommends that MBUST consider also establishing an institutional policy that "everything at MBUST has an expiration date," like the food in your refrigerator. All assumptions, degree programs, courses, policies and procedures must be periodically reviewed and reinvented in order to ensure that the latest discoveries are always reflected in the engineering research and teaching programs offered at MBUST. (Olin College adopted this principle at the beginning, and its culture of experimentation 20 years later remains extraordinary.) The process of renewal of these many key elements of the university should, ideally, be the result of wide community discussion and involvement, not the work of a few administrators who work in isolation and then announce a set of changes without engaging the faculty and students.

Finally, the author can report that the curriculum and learning model proposed by the faculty at the end of their inclusive and comprehensive design process was far superior to the white paper that the author kept in a drawer. It included new experimental results, involved elements of shared courses and learning experiences from neighboring colleges, and was presented in a most creative manner—as a three act play in a drama presentation. To say that their work exceeded the author's expectations would be a serious understatement. In addition, they thoroughly "owned" this curriculum and also enjoyed the process of developing it together. As a result, the curriculum does not depend on the president or an expert to develop. Now that the author has retired from the presidency of the College, this culture of experimentation and self-renewal remains vibrant to guide the future journey of continuous improvement and change.

VIII - Importance of External Engagement in Government, Business, and Academia. With all the intense focus on the academic mission of the new university, finances and campus

development, it is easy to overlook the importance of establishing a public identity and relationships with many stakeholders off campus. In particular, the government of Nepal has endowed MBUST with a special mission and purpose in the nation and given it special freedom to establish independence of operation and academic freedom. Furthermore, if MBUST is to fulfill its promise to play an important role in enhancing economic development, it must also establish and develop supportive relationships with corporations as partners in creation of the academic program and in supporting the new enterprises that are expected to flow from the institution. Finally, MBUST will also need close relationships with the existing academic institutions in Nepal and in Asia as it forges a new identity and role as an important influence for change throughout higher education. Beyond these obvious "partners" of MBUST in achieving its mission, MBUST must also find a way to be discovered in the public awareness as an exciting and important new institution where Nepal's best and brightest students will choose to enroll one day. These important needs, particularly in the first few years, will demand attention of the President and require her or him to take personal responsibility for establishing positive relationships off campus. Ideally, the President should look forward these opportunities to become a highly visible ambassador for MBUST in the public arena, tirelessly seeking every opportunity to tell the world about the important mission and purpose of MBUST in the media as well as in private meetings.

Ideally, the President and other representatives of MBUST will find ways to invite leading representatives from all of these groups to visit the campus and to become "thought partners" and advocates for the institution. MBUST will need to be recognized as unique and important by all of the constituencies, but this will require earning the respect of each group.

One method for doing this that worked well for Olin College was the early establishment of the President's Council. This is a group of influential people from many different communities (business, higher education, donors, K-12 education, etc.) who have been engaged in the development of Olin, meet on campus twice each year for about 24 hours in total at each meeting, and advocate for and support the credibility, importance, and mission of the College within their own spheres of influence. In addition, the President's Council provided important strategic advice in the early years, certain members of the Council also have become important financial supporters, and others later joined the Board of Trustees.

It is relatively easy to assemble and engage such a community. Upon first arrival at Olin College in 1999, the author felt a great deal of responsibility for creating an institution worthy of the major investments and powerful mission invested in the College by the F.W. Olin Foundation, and by academic leaders around the US who had heard about the creation of the College in a New York Times front page article in 1999. So, the author reached out to the most respected and accomplished engineering and academic leaders in the US to alert them to the establishment of Olin College and to tell them that the project was too important for any one person to make all the strategic decisions. He asked each person a simple question: "If you had the responsibility and authority to change one or two things about engineering education, what they be?" He found that almost everyone he contacted had strong opinions on this, and they freely offered advice. The author then told them that he welcomed their partnership in thinking through these issues and invited them to join the newly formed President's Council. Most of them did not hesitate to join the Council.

Having secured their attention and their willingness to attend the first couple of meetings, the next task was to frame an important strategic question for discussion at the meeting. (When engaging with CEOs and other important leaders, you should not be surprised if they are willing to be quite prescriptive with their advice, telling you exactly how to proceed. They are likely to

offer advice on many, many different things, and some of these issues are not helpful to you.) to establish some coherent direction for each meeting, the author took the time to write a brief white paper framing a specific issue of current importance to the establishment of the College and ending the paper with a few short questions that Council members were asked to respond to during the meetings. This helped a great deal in creating a series of strategically useful discussions. The meetings of the President's Council were scheduled to take place adjacent to a meeting of the Board of Trustees, to enable Trustees and Council members to have dinner together and to discuss together the issues framed in the white papers. (The white papers and recordings of guest presentations of the Olin President Council are available at this website.)

It is difficult to overstate the importance of the President's Council in establishing a community of advocates and in providing occasional strategic guidance. The Council involved some very influential people, including the President of the US National Academy of Engineering, the former President of the University of Michigan, the Dean of Engineering at MIT, the Provost at Caltech, the Chief Engineer at Raytheon Company, the co-founder of Boston Scientific Corporation, the Chief Engineer of Boeing Corporation, etc. A number of these members of the Council later became Trustees of the College, and all of them felt a sense of "ownership" of Olin, as their "laboratory school." The entire nation (and later the world) could learn from the experiments conducted at Olin College, because we explicitly took as our responsibility the task of sharing our results with everyone who was interested.

Regarding the business world, this will be an especially important community of partners for MBUST. It may be useful at the beginning to identify a reasonable number of potentially important companies in Nepal and surrounding countries where the research and teaching at MBUST is hoped will be influential. An invitation from the President of MBUST to meet and become introduced to the mission and purpose of MBUST, including an invitation to partner with MBUST to create a new curriculum and learning model that will help support significant economic development in the region might be a good place to start. If these business leaders feel valued by MBUST and welcome to participate in the development of the new curriculum, they are more likely to be open to sponsoring student design projects and supporting student and faculty internships and research and development projects in their corporations as the curriculum develops.

Regarding governmental relations, MBUST was made possible by recognition from the government and the granting of special independence and a powerful mission. It would seem important to make sure appropriate representatives of the government are engaged at each stage of the development of MBUST, with the intention of exceeding their expectations, making them proud of their decision to take a chance with their reputations and establish the university, and to support the university in every way they can. If they conclude that MBUST is doing so well and is becoming so important that they can't afford to let it fail, this will go a long way toward insuring the future support for the university. Perhaps appropriate representation of government officials on the President's Council or even the Board of Trustees might be the best approach.

Finally, regarding the public at large, a great deal of effort at the beginning should be directed toward developing public awareness of MBUST and its ambitions for changing lives as well as enhancing the economic development of Nepal. Prospective students and their parents are the most important members of the public at the early stages of the College. In the US, it is common for universities to obtain names and addresses of K-12 students who are considering which college to attend, and then to write to them directly, in large numbers. Careful attention must go to the design of any such material sent to these students. Creative admission

brochures can play an important role in attracting the best and brightest students to attend. Olin College had the benefit of a Vice President recruited away from the University of Southern California in Los Angeles as the director of this public awareness campaign, and the recruitment of the first class of students. Unorthodox methods were needed, since other well-established universities can brag about the Nobel Prize winners they have and the many highly visible alumni they have produced. Olin found that humor was very effective with 18 year old high school students and helped attract an exceptional group of highly talented risk-takers who become the Olin Partners—and later the first incoming class. For example, one of our early mailings to prospective students stated: "When people ask you where you are going to college, tell them you are building your own!" This helped recruit the Olin Partners. Another mailing was in the form of a newspaper tabloid with a picture of aliens on the cover. It had a cartoon of a flying saucer dropping a new campus from cables on the hilltop where Olin's campus would be built and included a nonsense headline like "Aliens invade Needham Massachusetts and overnight create a new engineering campus." It had drawings of supposed aliens that look like something from an animated science fiction movie. Then another article on the front page included a photograph of Prof. Sherra Kerns, one of our founding Vice Presidents, in a turban and holding a crystal ball. The headline read "Sister Sherra Predicts" and it went on to tell this nonsense tale that Olin College, with help from aliens, would become recognized as the most innovative engineering college in the US within 20 years. (Very surprisingly, this humorous prediction in the tabloid actually came true in the 2018 report by MIT about the most respected engineering schools in the world, where Olin College was identified as #1 in the world.)

IX - Summary and Conclusions. In the three days available to the author to provide engagement with the MBUST about this ambitious project, it was not possible to cover all the important aspects of establishing a new university with the important mission and purpose of MBUST. This report covers most of the high-level topics that were discussed with the Development Board. Additional discussions of some topics in more detail took place in four two-hour conversations via Zoom technology with the members of the Development Board. These conversations were recorded, and they provide supplemental information that is not fully covered in this written report. As MBUST progresses with the project, additional conversations might be needed to address the numerous other topics that arise as the project unfolds.

In considering last thoughts to those who will lead this important project, the author would like to share some historic words that he has found to be reassuring and inspirational during the difficult days, when unexpected challenges arise and the problems seem overwhelming. In particular, two quotes come to mind that were captured on plaques that hung on the wall in his office at Olin College for 20 years. The first quote is by Nicolo Machiavelli, as published his book *The Prince,* published more than 500 years ago in 1513:

> "It ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new. This coolness arises partly from fear of the opponents, who have the laws on their side, and partly from the incredulity of men, who do not readily believe in new things until they have had a long experience of them."

The other quote is from US President Theodore Roosevelt, in his speech at the Sorbonne in Paris, given more than 100 years ago in 1910:

> "It is not the critic who counts, not the one who points out how the strong man stumbled or how the doer of deeds might have done them better. The credit belongs to the man who is actually in the arena, whose face is marred with sweat and dust and blood; who strives valiantly; who errs and comes short again and again; who knows the great enthusiasms, the great devotions, and spends himself in a worthy cause; who, if he wins, knows the triumph of high achievement; and who, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who know neither victory nor defeat."

The challenges that lie ahead in leading a change in the order of things in Nepal are immense, and the world is full of critics, who point out from the safety of the audience, how the leader failed to achieve what he had hoped and could have done better. But in the end, the mission of MBUST is worthy of the rest of the careers of the best and brightest patriots in Nepal in order to create a better future for your children and your children's children.

APPENDIX – QUESTIONS PROVIDED BY PROFESSOR JOSHI

Key Issues for Discussion with Prof. Miller for December 21, 2020

1. The Government support for alone will not ensure sufficient resources for MBUST to develop as a world-class university. Therefore, MBUST has established an Endowment Fund. What initiatives should MBUST take to grow the Fund to a significant size? What options should MBUST consider for management and investment of the Fund?
2. For implementation of the project-based learning approach there needs to be capacity for financing of projects. How expensive is the project-based approach compared to traditional approach?
3. To what extent resources for project financing can be mobilized from tuition and financing from businesses?
4. The ability to deliver world-class education largely hinges upon the ability to attract talented students. And there is a fierce completion for talented students between universities. In this environment what percentage of operating costs of universities aspiring to become world-class can be financed from student tuition?
5. Needs blind selection of students is perhaps the best approach for admitting the best students. Universities adopting this approach too seem to raise funds from tuition. How does this work? Does this practice compromise the admission of best students?
6. MBUST is considering fully financing master's students but charging bachelor's students based on their ability to pay. Is this strategy practical? What would be implications of this strategy on the ability to attract bright students?
7. To break disciplinary silos Olin has successfully implemented an organizational structure without silos. What are the challenges for implementation of this approach at MBUST? How does this system work?
8. What are the attributes of good trustees? What are the good practices for selection of trustees?
9. There is a perception that on campus residence of students significantly enhances the quality of education. Fully residential campuses are expensive. MBUST is considering the option of not building residential facilities but creating an environment for students to spent most of their time on campus making available for them work space as well as leisure facilities. Would it compromise the aspiration of MBUST to become world-class?
10. How critical is on-campus residential facilities for faculty?
11. Olin does not have a tenure track for the faculty? Is Olin providing other incentives in lieu of the tenure to attract bright faculty?
12. COVID has forced extensive use of online delivery of instruction. Notwithstanding the limitations of online instruction, it appears that there is a scope for increased use of online instruction based on instructional practice during COVID. Are there studies examining the scope of increased use of online instruction?
13. Collaboration with good universities is critical for MBUST? What tips would you provide for developing collaboration with best universities of the world? Is there is scope for collaboration with Olin?
14. MBUST aims at playing a catalytic role for triggering rapid growth of the economy. With this in mind it is planning to focus on selected areas of economy with promising prospects for development. Research and academic programs in the MBUST will be guided by the areas of research relevant for the selected areas of the economy. This approach contrast

with the traditional discipline driven approach of university development. Is this a rational approach? What are the pitfalls of this approach?

15. Forest Biomaterials Science and Engineering, Organic Agriculture and Artificial intelligence and three areas selected for PG programs and research. Master's programs will be mostly research-based. Master's programs will be added as new areas of engagement are identified and support from other disciplines become necessary for the identified area. Initially 6-8 students will be enrolled into master's programs and 2-4 students at PhD programs. Bachelor's programs will be started a few years later. What are the implications of this approach MBUST should be careful about?
16. MBUST has to be able to attract foreign faculty and students. What are key considerations for meeting this goal?
17. Developing new technology and patenting will be given priority from the outset. What strategies should MBUST adopt to achieve success in this front?
18. In terms of contribution to patenting East Asian Universities have been relatively more successful. MBUST aims at imitating their approach. Would this be feasible?
19. Can royalties from patents become a major source of income for MBUST?
20. The industrial sector in Nepal is not yet well developed. Therefore, they will have limited ability to adopt new technology developed by MBUST. MBUST wishes to forge collaboration between foreign universities and industries - local and foreign – in the areas of mutual commercial interests. What strategies should MBUST adopt to realize this goal?