REPUBLIK INDONESIA
KEMENTERIAN HUKUM DAN HAK ASASI MANUSIA

SURAT PENCATATAN
CIPTAAN

Dalam rangka pelindungan ciptaan di bidang ilmu pengetahuan, seni dan sastra berdasarkan Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta, dengan ini menerangkan:

Nomor dan tanggal permohonan	:	EC00202112868, 24 Februari 2021
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Kewarganegaraan	:	Indonesia
Pemegang Hak Cipta		
Nama	:	**UNIVERSITAS NEGERI MAKASSAR**
Alamat	:	Jln. A.P. Pettarani, Makassar, SULAWESI SELATAN, 90222
Kewarganegaraan	:	Indonesia
Jenis Ciptaan	:	**Laporan Penelitian**
Judul Ciptaan	:	**FRAMEWORK PENINGKATAN KUALITAS DATA DAN INFORMASI PENDIDIKAN TINGGI DI INDONESIA**
Tanggal dan tempat diumumkan untuk pertama kali di wilayah Indonesia atau di luar wilayah Indonesia	:	1 Maret 2019, di Makassar
Jangka waktu pelindungan	:	Berlaku selama 50 (lima puluh) tahun sejak Ciptaan tersebut pertama kali dilakukan Pengumuman.
Nomor pencatatan	:	000239707

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Surat Pencatatan Hak Cipta atau produk Hak terkait ini sesuai dengan Pasal 72 Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta.

a.n. MENTERI HUKUM DAN HAK ASASI MANUSIA
DIREKTUR JENDERAL KEKAYAAN INTELEKTUAL

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LAPORAN PENELITIAN

PENELITIAN TERAPAN UNGGULAN PERGURUAN TINGGI

FRAMEWORK PENINGKATAN KUALITAS DATA DAN INFORMASI PENDIDIKAN TINGGI DI INDONESIA

TAHUN 1 DARI RENCANA 3 TAHUN

Ketua/Anggota Tim

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Dibiayai oleh:
Direktorat Riset dan Pengabdian Masyarakat
Direktorat Jenderal Penguatan Riset dan Pengembangan
Kementerian Riset, Teknologi, dan Pendidikan Tinggi
Sesuai dengan Kontrak Penelitian Tahun Anggaran 2019
Nomor: 146/UN36.9/PL/2019

UNIVERSITAS NEGERI MAKASSAR

MARET 2019

Pengisian poin C sampai dengan poin H mengikuti template berikut dan tidak dibatasi jumlah kata atau halaman namun disarankan seringkas mungkin. Dilarang menghapus/memodifikasi template ataupun menghapus penjelasan di setiap poin.

C. **HASIL PELAKSANAAN PENELITIAN:** Tuliskan secara ringkas hasil pelaksanaan penelitian yang telah dicapai sesuai tahun pelaksanaan penelitian. Penyajian meliputi data, hasil analisis, dan capaian luaran (wajib dan atau tambahan). Seluruh hasil atau capaian yang dilaporkan harus berkaitan dengan tahapan pelaksanaan penelitian sebagaimana direncanakan pada proposal. Penyajian data dapat berupa gambar, tabel, grafik, dan sejenisnya, serta analisis didukung dengan sumber pustaka primer yang relevan dan terkini.

Hasil Penelitian Ronde Pertama

1. Dimensi Kualitas Data/Informasi Pendidikan Tinggi

Sebanyak 33 dimensi data dan informasi yang ditawarkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, diperoleh dimensi kualitas data dan informasi sebanyak 16 item. Keseluruhan 16 butir item dimensi tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

2. Masalah Kualitas Data/Informasi Pendidikan Tinggi

Terdapat sebanyak 88 item usulan tentang masalah kualitas data dan informasi pendidikan yang terjadi pada institusi tinggi yang ditawarkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam aspek teknologi, organisasi dan personal, diperoleh sebanyak 17 masalah kualitas data dan informasi untuk katagori masalah teknologi, sebanyak 19 katagori masalah organisasi, dan 7 masalah yang dikatagorikan personal. Keseluruhan 43 butir masalah kualitas data/informasi tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

3. Faktor yang Menyebabkan Timbulnya Masalah Kualitas Data/Informasi

Untuk pertanyaan yang berhubungan dengan factor apa saja yang dinilai mempengaruhi terjadinya masalah kualitas data dan informasi yang telah diajukan terlebih dahulu oleh seluruh responden, diterima sebanyak 112 item usulan tentang factor yang dinilai mempengaruhi masalah kualitas data dan informasi pendidikan yang terjadi pada institusi tinggi yang ditawarkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam aspek teknologi, organisasi dan personal, diperoleh sebanyak 26 faktor penyebab masalah kualitas data dan informasi untuk katagori masalah teknologi, sebanyak 30 faktor dalam katagori masalah organisasi, dan 8 faktor penyebab masalah yang dikatagorikan personal. Keseluruhan 64 butir masalah kualitas data/informasi tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

4. Cara Mengidentifikasi dan Strategi Memperbaiki Kualitas Data dan Informasi

Terhadap pertanyaan "Bagaimana cara menidentifikasi dan memperbaiki masalah kualitas data dan informasi" diperoleh 42 jawaban, baik berupa kalimat pendek (parase) maupun kalimat lengkap. Setelah dilakukan perbaikan (revisi) parase dan kalimat, ditetapkan 2 cara identifikasi dan 2 strategi peningkatan atau perbaikan kualitas data dan informasi pada institusi pendidikan tinggi. Ke 4 cara identifikasi berikut strategi perbaikannya diajukan kembali pada Ronde kedua untuk mendapatkan tanggapan dari seluruh respondent.

5. Kriteria Pemilihan Software atau Aplikasi

Setelah dilakukan analisa konten, seluruh jawaban dari responden dibagi kedalam tiga katagori yaitu: (1) Fungsional, yang berisi 16 katagori pilihan; (2) Non-Fungsional, yang berisi 12 katagori pilihan; dan (3) Aspek Komersial, yang berisi 3 katagori pilihan. Sebanyak 31 aspek pemilihan yang tersebar dalam 3 katagori diatas diperolah dari analisis sebanyak 42 aspek pemilihan dari 21

responden pada Ronde pertama. Seluruh 31 aspek pemilihan yang tersebar dalam 3 katagori ini diajukan untuk memperoleh tanggapan responden pada Ronde kedua.

6. Peran Teknologi Komunikasi Bergerak yang Diharapkan

Dari sebanyak 32 statemen dari 21 responden Ronde pertama, dilakukan analisa konten, dan selanjutnya dibagi kedalam tiga katagori yang berisi harapan kemampuan teknologi komunikasi bergerak untuk mendukung pembelajaran bergerak dengan data dan informasi yang berkualitas, yaitu: (1) Fleksibel, yang berisi 6 macan ; (2) Perbaikan Pengelolaan, yang berisi 7 macam; dan (3) Aspek Lain, yang berisi 4 komentar tentang perkembangan tekmologi komunikasi bergerak yang sedang dan akan digunakan pada pendidikan tinggi.. Seluruh 17 harapan dan tanggapan tentang peran teknologi komunikasi bergerak dalam menunjang peningkatan proses belajar dan pengambilan keputusan dalam dunia perguruan tinggi diajukan untuk memperoleh tanggapan responden pada Ronde kedua.

7. Kelebihan Mobile Collaborative Learning dalam Perspektif Kualitas Data/Informasi

Untuk pertanyaan yang berhubungan dengan kelebihan dari mobile collaborative learning (MCL) yang didukung oleh data dan informasi yang berkualitas, telah diterima sebanyak 37 unsur kelebihan yang dinilai menunjang peningkatan kualitas pengambilan keputusan berbasis kualitas data dan informasi pendidikan tinggi. Jawaban tersebut disebutkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam katagori Komunikasi, Koordinasi, Kerjasama, dan Produktifitas. Dalam katagori komunikasi, diperoleh sebanyak 6 unsur kelebihan, untuk katagori kordinasi, sebanyak 5 unsur kelebihan, dalam katagori kerjasama, 6 unsur kelebihan, dan 12 unsur kelebihan dalam katagori produktifitas. Keseluruhan 29 unsur kelebihan dari MCL tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

8. Permasalahan Dasar Mobile Collaborative Learning

Dari sebanyak 30 statemen dari 21 responden Ronde pertama, dilakukan analisa konten, dan selanjutnya dibagi kedalam 4 katagori yang berisi permasalahn mendasar dari MCL dalam mendukung pembelajaran bergerak dengan data dan informasi yang berkualitas, yaitu: (1) Kesiapan Teknology, yang berisi 3 masalah dasar ; (2) Kesiapan berkolaborasi, yang berisi 6 masalah dasar; (3) Budaya/Individu, yang berisi 9 masalah dasar dan (4) Aspek Komersial, yang berisi 1 masalah dasar. Seluruh 19 permasalahan dasar MCL tersebut diajukan pada Ronde kedua untuk memperoleh tanggapan responden.

Hasil Penelitian Ronde Kedua

1. Dimensi Kualitas Data/Informasi Pendidikan Tinggi

Dimensi atau syarat kualitas data dan informasi yang relevan untuk PT seperti yang dapat dilihat pada Tabel 1.

Tabel 1 Dimensi kualitas data dan informasi untuk pendidikan tinggi

Accessibility	Free-of –error
Appropriate amount of data	Interpretability
Believability	Objectivity
Accuracy	Relevancy
Completeness	Reputation
Concise representation	Security
Consistent representation	Timeliness
Ease of manipulation	Understandability

2. Masalah Kualitas Data/Informasi Pendidikan Tinggi

Terdapat sebanyak 88 item usulan tentang masalah kualitas data dan informasi pendidikan yang terjadi pada institusi tinggi yang ditawarkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam aspek teknologi, organisasi dan personal, diperoleh sebanyak 17 masalah kualitas data dan informasi untuk katagori masalah teknologi (Tabel 2), sebanyak 19 katagori masalah organisasi (Tabel 3), dan 7 masalah yang dikatagorikan personal (Tabel 4). Keseluruhan 43 butir masalah kualitas data/informasi tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

Tabel 2. Masalah Teknologi, kualitas data dan informasi

Masalah Teknologi KDI
1. System integration
2. Mobility-Data and services through contextualized and mobile interface
3. Data and services functionality porting to the cloud
4. Autonomous information/communication exchange
5. Configurability-Deployment
6. Database synchronisation
7. Support of computing infrastructure resources
8. Systematic asset description
9. System adoption, implementation and documentation
10. Capability constraint of system
11. User interface
12. Data cleansing
13. Use of DIQ enabling tools
14. Data gap between asset maker/provider and asset user
15. Automated data/information capture
16. DIQ monitoring
17. DIQ verification

Tabel 3. Masalah Organisasi, kualitas data dan informasi

Masalah Organisasi KDI
1. Cross- Study Programs management communication
2. Appropriate coordination mechanism of the team
3. Data input control
4. Disparate data/information sources
5. Clear data/information vision (DIQ strategy-Institution objective)
6. Data integration
7. Use of data
8. Awareness of organizational implication of new academic information systems
9. Large volumes of data (big data)
10. Institutional structure

11. IT Governance
12. Manual/paper based data acquisition
13. Information supplier's quality management
14. Information need analysis
15. Unfocus data collection
16. Data access and coordination access across Schools/Department/Study Programs
17. Commitment of senior management
18. Process evaluation, review/audit
19. DIQ policies and support

Tabel 4. Masalah Personal, kualitas data dan informasi

Masalah Pengguna KDI
1. Informal social communication between personnel
2. Craft skill and training
3. Personal competency and experience
4. Data stewardship
5. Disconnect among data stakeholders
6. Teamwork
7. Performance evaluation and motivation

3. Faktor yang Menyebabkan Timbulnya Masalah Kualitas Data/Informasi

Untuk pertanyaan yang berhubungan dengan factor apa saja yang dinilai mempengaruhi terjadinya masalah kualitas data dan informasi yang telah diajukan terlebih dahulu oleh seluruh responden, diterima sebanyak 112 item usulan tentang factor yang dinilai mempengaruhi masalah kualitas data dan informasi pendidikan yang terjadi pada institusi tinggi yang ditawarkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam aspek teknologi, organisasi dan personal, diperoleh sebanyak 26 faktor penyebab masalah kualitas data dan informasi untuk katagori masalah teknologi (Tabel 5), sebanyak 30 faktor dalam katagori masalah organisasi (Tabel 6), dan 8 faktor penyebab masalah yang dikatagorikan personal (Tabel 7). Keseluruhan 64 butir masalah kualitas data/informasi tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

Tabel 5. Masalah dan Faktor Penyebab Masalah KDI (Perspektif Teknologi)

Masalah Teknologi KDI	**Faktor Penyebab**
1. System integration	*System integration*
2. Mobility-Data and services through contextualized and mobile interface	*Software (features choose)*
	Mobility of data and services access
	Mobility of data/information collector
3. Data and services functionality porting to the cloud	*System adoption/implemented*
	Accessibility of big data

	Online interaction
4. Autonomous information/communication exchange	*System adoption/implemented*
	Mobile collaboration
5. Configurability-Deployment	*Interoperability*
	Speed readiness of devices/tools
6. Database synchronisation	*Database synchronization*
7. Support of computing infrastructure resources	*Support of sufficient computing resources*
	Infrastructure support
8. Systematic asset description	
9. System adoption, implementation and documentation	*Adoption of IT systems*
	System implementation
	Use multiple versions of software
	Standardization of system documentation
10. Capability constraint of system	*System constraint*
11. User interface	*User interface*
12. Data cleansing	*Use of software*
13. Use of DIQ enabling tools	*Use of DIQ tools*
14. Data gap between asset maker/provider and asset user	*Data gap between the maker and user of asset*
	Conditional provision of information
15. Automated data/information capture	
16. DIQ monitoring	*Monitoring systems*
17. DIQ verification	*System standardization*

16 dan 17 disatukan pada Ronde III atas permintaan Respondent

Tabel 6. Masalah dan Faktor Penyebab Masalah KDI (Perspektif Organisasi)

Masalah Organisasi KDI	**Faktor Penyebab**
1. Cross-Study Programs management communication	*Communication/ collaboration*
2. Appropriate coordination mechanism of the team	*Direct link priority*
	Regular meeting
3. Data input control	*Data input control*
4. Disparate data/information sources	*Integration of disparate information sources*
	Use of verbal information
5. Clear data/information vision (DIQ strategy-Institution objective)	*Academic process flow*
	Operational merit
	Quality assurance
6. Data integration	*Data integration*
7. Use of data	*Data use for academic (LMS)*
	Treatment of LMS
8. Awareness of organizational of new academic	*New skills requirements*

information systems	*Role change* *University/institution organization structure*
9. Large volumes of data (big data)	*Collection of big data* *Analysis of big data* *Distribution*
10. Institutional structure	
11. IT Governance	*Data transparency*
12. Manual/paper based data acquisition	*Manual/paper-based data collection & entry* *Data capture process*
13. Information supplier's quality management	*Information supply from suppliers*
14. Information need analysis	*Identification of needs for data/information*
15. Unfocus data collection	*Planning* *Guidance*
16. Data access and coordination access across Schools/Department/Study Programs	*Coordination od data/information*
17. Commitment of senior management	*Dean, Rector (and others First level management) commitment*
18. Process evaluation, review/audit	*Business process review*
19. DIQ policies and support	*Staff/lecturer support* *System support*

7 dan 14 disatukan pada Ronde III atas permintaan Respondent

12 dan 13 disatukan pada Ronde III atas permintaan Respondent

Tabel 7. Masalah dan Faktor Penyebab Masalah KDI (Perspektif Personal)

Masalah Pengguna KDI	**Faktor Penyebab**
1. Informal social communication between personnel	*Communication, friendship*
2. Craft skill and training	*Education and specific training*
3. Personal competency and experience	*Recruitment pattern*
4. Data stewardship	*Data stewardship*
5. Disconnect among data stakeholders	*Awareness of importance of data production* *Knowledge gap between data collector and data entry staff (in SP or Department/School)*
6. Teamwork	*Awareness, mutual advantages working in team and individual*
7. Performance evaluation and motivation	*Self motivation for data/information collection*

1 dan 6 disatukan pada Ronde III atas permintaan Respondent

4. Cara Mengidentifikasi dan Strategi Memperbaiki Kualitas Data dan Informasi

Terhadap pertanyaan "Bagaimana cara menidentifikasi dan memperbaiki masalah kualitas data dan informasi" diperoleh 42 jawaban, baik berupa kalimat pendek (parase) maupun kalimat lengkap. Setelah dilakukan perbaikan (revisi) parase dan kalimat, ditetapkan 2 cara identifikasi dan 2 strategi peningkatan atau perbaikan kualitas data dan informasi pada institusi pendidikan tinggi. Ke 4 cara identifikasi berikut strategi perbaikannya diajukan kembali pada Ronde kedua untuk mendapatkan tanggapan dari seluruh respondent.

Kalimat telah direvisi berdasarkan saran dan perbaikan dari beberapa panelis, sebagai berikut:

Identified some of the most common issues with data. Data resides in silos, as do inefficient, manual data entry processes that are slow and error-prone. Data management roles aren't clearly defined, and there's a lack of communication between departments. All of these problems contribute to inaccuracy in data and an inability to properly monitor data as well as information for quality.

In higher education, data quality issues are similar. They typically involve incomplete and out-dated information, which often exists in silos. There is a lack of ownership and responsibility of data, especially in study program level. This can result in operational inefficiency, the inability to understand and improve the student experience, and failure to identify at-risk students and offer the appropriate assistance.

An effective data quality strategy begins with collaboration between data creators and end-users to pinpoint the root cause of quality issues. This way, these problems **can be fixed** when data is created rather than forcing assigned staff (IT people) to correct or work around bad data. Instead of focusing on cleaning up existing data, HE Institutions should work to improve the quality of new data at the point of creation, which will limit how often data clean-ups are required. Finally, DIQ problems shouldn't be dumped on IT's plate. IT sees little benefit from good data and little pain from bad data. Data should be the responsibility of creators, who benefit the most from having access to quality data/information.

Aggregating all data into a centralized system. Regardless of source, data is integrated and validated while sophisticated matching algorithms eliminate duplicate records. All data can then be managed through a simple, intuitive interface, or send it to the cloud whenever needed.

5. Kriteria Pemilihan Software atau Aplikasi

Setelah dilakukan analisa konten, seluruh jawaban dari responden dibagi kedalam tiga katagori yaitu: (1) Fungsional, yang berisi 16 katagori pilihan (Tabel 8); (2) Non-Fungsional, yang berisi 12 katagori pilihan (Tabel 9); dan (3) Aspek Komersial (Tabel 10), yang berisi 3 katagori pilihan. Sebanyak 31 aspek pemilihan yang tersebar dalam 3 katagori diatas diperolah dari analisis sebanyak 42 aspek pemilihan dari 21 responden pada Ronde pertama. Seluruh 31 aspek pemilihan yang tersebar dalam 3 katagori ini diajukan untuk memperoleh tanggapan responden pada Ronde kedua.

Tabel 8. Kriterea Fungsional Paket Sofware/Aplikasi KDI

Selection area	Selected selection categories
Functional Features	• Shared space with media rich content
	• Access to portable devices
	• Cloud oriented
	• Integration for information exchange
	• Ability to harvest data from multiple sources
	• Customisable with several configuration options for the administrator, while hiding complexity for the user

	• Allowing scribbling on the screen
	• Backlog-work orders planned and prioritized, waiting scheduling and execution to support IT crew.
	• Q & A platform forum
	• Audio and video teleconferencing capabilities
	• Predictive and preventive maintenance scheduling
	• Shared note taking application
	• Stock inventory for university asset management
	• Deployment easy
	• Support email and SMS alert for high and medium priority
	• Able to mark up entire job plan

Tabel 9. Kriterea Non-Funfsional Paket Sofware/Aplikasi KDI

Selection area	Selected selection categories
Non Functional Features	• Scalable architecture
	• Facilitating interfaces development to other software (technical & cost-wise)
	• Support for mobile devices
	• Usability: intuitiveness of user-friendly interfaces
	• Reliability/fault tolerance: in term of data security and integrity
	• Synchronous/asynchronous (online/offline) seamless operation
	• Report generation supporting different file formats
	• The device's size is suitable for field site/light weight
	• Real-time capability
	• Software workflow flexible to academic business process change & update
	• Key performance indicator (KPI) support
	• Long-time battery life

Tabel 10. Kriterea Komersil Paket Sofware/Aplikasi KDI

Commercial aspects	• Compatibility/interoperable with others non academic information systems package
	• Install platform/market share*
	• Match to the University's business activities

* Dicapai Konsesnsus Tidak Setuju

6. Peran Teknologi Komunikasi Bergerak yang Diharapkan

Dari sebanyak 32 statemen dari 21 responden Ronde pertama, dilakukan analisa konten, dan selanjutnya dibagi kedalam tiga katagori yang berisi harapan kemampuan teknologi komunikasi bergerak untuk mendukung pembelajaran bergerak dengan data dan informasi yang berkualitas, yaitu: (1) Fleksibel, yang berisi 6 macan (Tabel 11); (2) Perbaikan Pengelolaan, yang berisi 7 macam

(Tabel 12); dan (3) Aspek Lain (Tabel 13), yang berisi 4 komentar tentang perkembangan tekmologi komunikasi bergerak yang sedang dan akan digunakan pada pendidikan tinggi.. Seluruh 17 harapan dan tanggapan tentang peran teknologi komunikasi bergerak dalam menunjang peningkatan proses belajar dan pengambilan keputusan dalam dunia perguruan tinggi diajukan untuk memperoleh tanggapan responden pada Ronde kedua.

Tabel 11. Kriterea Fleksibel Peran Teknologi Komunikasi Bergerak

Area	Feature category
Flexibility *(initiate application at flexible sites in unstructured networked)*	• Visualising of collected data, parameter history and trending.
	• Contextualising access over remote data and services: task-related services and data entry ubitously available to authorised users/university members (active students, staffs, lectures).
	• Critical for response time for data or information that can lead to early correction and or identification of failures.
	• Providing the notification of failure through mobile devices
	• Detecting the location of skilled IT personel nearby Studi Program that has experienced a failure through GPS (for Help Desk purposes).
	• Mobile technology allows at the right place to access directly to a set of information in the form of learning materials (online, share courseware and share content),

Tabel 12. Kriterea Manajemen (Pengelolaan) Peran Teknologi Komunikasi Bergerak

Area	Feature category
Empowering management	• Resources management (learning material, lecturer) facilitator for continous task monitoring/assignment/ evaluating/reporting.
	• Building and identifying process verification tasks, approvals.
	• It helps to report failure effectively and report university members actual working hours and availability.
	• Allowing to take the right administrative/academic/research decision, at the right time, at the right place, from the right information.
	• Enhancing accuracy of critical data entry for student/lecture history.
	• Holiday (not in office) notifications and live feeds.
	• Q/A decisions

Tabel 13. Kriterea Lain Peran Teknologi Komunikasi Bergerak

Area	Feature category
Others	• In the technology adoption lifecycle I'd say it's at the "moment of adopters" stage. Somehow there are big expectations on the role of mobile technology, and I think we're approaching the "peak of inflated expectations".
	• I have seen it in action and it is a must in today's HE development from time keeping for online learning or at least blended learning context.
	• In developing countries this is limited use at the moment, still structured and static approach.

	• It is still very limited as HE institution don't tend to invest in such luxury features. Eventhough current mobile solutions are relatively mature enough in academic context.

7. Kelebihan Mobile Collaborative Learning dalam Perspektif Kualitas Data/Informasi

Untuk pertanyaan yang berhubungan dengan kelebihan dari mobile collaborative learning (MCL) yang didukung oleh data dan informasi yang berkualitas, telah diterima sebanyak 37 unsur kelebihan yang dinilai menunjang peningkatan kualitas pengambilan keputusan berbasis kualitas data dan informasi pendidikan tinggi. Jawaban tersebut disebutkan oleh 21 panelis Delphi studi pada Ronde pertama. Setelah dilakukan analisis konten, dan pengelompokan dalam katagori Komunikasi, Koordinasi, Kerjasama, dan Produktifitas. Dalam katagori komunikasi, diperoleh sebanyak 6 unsur kelebihan (Tabel 14), untuk katagori kordinasi, sebanyak 5 unsur kelebihan (Tabel 15), dalam katagori kerjasama, 6 unsur kelebihan (Tabel 16), dan 12 unsur kelebihan dalam katagori produktifitas (Tabel 17). Keseluruhan 29 unsur kelebihan dari MCL tersebut diajukan kembali untuk memperoleh persetujuan responden pada Ronde kedua.

Tabel 14. Kelebihan dalam Katagori Komunikasi pada Mobile Collaborative Learning

Benefit area	Selected benefit categories
Networking/ Communication	• Reduce of waste (time, task overlap, task complimentarity) due to better communication
	• Information/data triangulation (coupling of different University stakeholder's views/undrstandings), self-institution and emerging approaches for conducting the academic tasks in opposition to imposed and rigid manners to develop University.
	• It is a relevant item in the way to be able to take the right academic/administrative/management related decision, at the right time, at the right place, from the right information.
	• Direct data/information (new and revsed version) input from anywhere might allow someone having to enter the information and possible collaborative work with others
	• Remote reviewing of feedback by a supervisor-student
	• Track inventories in realtime.

Tabel 15. Kelebihan dalam Katagori Kordinasi pada Mobile Collaborative Learning

Benefit area	Selected benefit categories
Coordination	• Scale responsiveness and Study Program coordination
	• Ability to develop a complete learning/research strategy that includes planning and unplanning academic tasks.
	• More eyes over shared items leads to better potentials to identify weak points and problems
	• Improved coordination and cooperation between lecturer-staff in term of academic quality assurance on the fly.
	• Effectively deploy available learning resources (class, skills and laboratory support equipment)

Tabel 16. Kelebihan dalam Katagori Kerjasama pada Mobile Collaborative Learning

Benefit area	Selected benefit categories
Cooperation	• Build a better understanding for responsibilities and hierarchy
	• Faster and more effective performance enhancement action plan implementation throughout the university.
	• Increased sense of confidence as university members would feel continuously members of an overall team that is always available to support them, while they build their own contribution
	• Establishing a shared and commonly perceived institutional culture: supervising young staff/lecture would be able to participate and oversee the collaborating environment; interacting at peer level, having team-wide scope and goals in their academic actions
	• Standardisation of learning process and evaluation (including online quiz), language, approach, solutions.
	• Cumulative learning-increase learning curve

Tabel 17. Kelebihan dalam Katagori Produktifitas pada Mobile Collaborative Learning

Benefit area	**Selected benefit categories**
Productivity	• Sustainability – the system will remain running even if one person leave
	• Provides the intelegent repository of data/information. Historical data/information can be used to enhance the University plans, Performance Indicator (PI) and support better decesion making.
	• Improved craft University productivity.
	• More planned work leading to greater uptime and Overall Effectiveness (OEE)
	• Increased capacity, throughput and World Class achievement
	• Real-time information enabling right and quick decision making
	• Greater probability of achieving THE GOAL-Total acdemic Success
	• Visibility to problems
	• Increase staff/lecture productivity
	• Increase transperency (IT Government)
	• Help Study Program/Departments to reduce costly downtime- control expenses
	• Log and record personnel performance as University group members (stakeholders)

8. Permasalahan Dasar Mobile Collaborative Learning

Dari sebanyak 30 statemen dari 21 responden Ronde pertama, dilakukan analisa konten, dan selanjutnya dibagi kedalam tiga katagori yang berisi permasalahan dasar pembelajaran kolaborasi bergerak (MCL) dengan data dan informasi yang berkualitas, yaitu: (1) Kesiapan teknologi, yang berisi 3 masalah (Tabel 18); (2) Kesiapan Perangkat pembelajaran kolaborasi yang berisi 6 masalah (Tabel 19); (3) Masalah budaya atau kebiasaan (Tabel 20), yang berisi 9 masalah; dan (4) Masalah Ekonomi yang berisi 1 masalah (Tabel 21). Seluruh 19 harapan dan tanggapan tentang peran teknologi komunikasi bergerak dalam menunjang peningkatan proses belajar dan pengambilan

keputusan dalam dunia perguruan tinggi diajukan untuk memperoleh tanggapan responden pada Ronde kedua.

Tabel 18. Masalah Kesiapan Teknologi

Area	Typical issue categories
Mobile collaborative technology readiness	• The role of technology to facilitate collaborative learning is moderate significantly by Human Computer Interface factor.
	• Technology does not operate as expected in real world, energy is still an open problem for many contexts; e.g., remote campus (class) has to be adapted to batteries availability/charge.
	• Security becomes even more important and complex.

Tabel 19. Masalah Kesiapan Berkolaborasi

Area	Typical issue categories
Collaborative learning readiness	• Establishing common ground is a crucial activity for collaboration in learning context
	• Competing objectives or interest within the group (students and lectures)
	• Competing requirements of time if group is not dedicated to collaborative learning
	• Lack of support from University First Level Management
	• Too much sharing of specific assignement/quiz/homework in collaboration may make it hard to make it consistent and finalise (marking) it.
	• Shared response with collaboration may lead to decentralisation of true responsibility over decisions and actions.

Tabel 20. Masalah Budaya (kebiasaan)

Area	Typical issue categories
People and Culture	• Lack of knowledge of todays best practices by top University/School/Study Program leaders.
	• Approriate expertise on both sides (industry/provider and academia)
	• Availability and responsiveness of skilled personnel
	• Culture – sharing of academic information and data and collaborating in a University can generate big problems between thestudets because of the inertia of their backgrounds
	• Lack of commitment of resources
	• Individual task possibly conflict with other planned or regular assignments from different courses.
	• Negative reactions of the students due to “technological shock” and the perception that it will increase workload
	• Misuse of the system – degrading to a simple chatting and irrelevant file sharing tool
	• Recording and monitoring of performance at all levels may cause anxiety to supervised students.

Tabel 21. Masalah Ekonomi

Area	Typical issue categories
Economical aspect	Funding

Ringkasan Analisa Data Ronde Kedua

Ronde kedua berusaha merumuskan konsensus atau persetujuan dengan pernyataan deklaratif yang dihasilkan dari Ronde pertama. Salah satu tujuan dari metode Delphi adalah mencapai consensus [1] [2] [3]. Anggota panel Delphi studi diminta persetujuan atau ketidaksetujuan dengan skala berikut: 1 = tidak setuju; 2 = netral; 3 = setuju. Sebagian pertanyaan telah mencapai konsensus para anggota panel (respondent) pada Ronde kedua ini. Konsensus dinyatakan dicapai jika telah dicapai kesepakatan pada suatu pernayataan yang sama dari lebih besar atau sama dengan 70% panel pakar [4] [5] [6]. Sebagian yang lain diteruskan pada Ronde ketiga untuk mencapai konsensus tentang urutan prioritas. Tabel 22 dibawah ini menampilkan data kuantitatif konsessus yang dicapai pada Ronde kedua. Hasil analisa data Ronde kedua dapat dilihat pada Lampiran 1

Tabel 22. Tabel konsesnsus Ronde kedua

Agreement level	Themes																	Total
	HE DIQ Problems			Selection Criteria of DIQ Tools			Expected Mobile Technology Roles			Benefits of Collaborative Learning				Problems/ Issues on M-Learning				
	Technological	Organisational	People	Functional Features	Non Functional Features	Commercial Aspects	Flexibility	Empowering Management	Others	Networking/Communication	Coordination	Cooperation	Productivity	Technology Readiness	Collaboration Readiness	People readiness	Economical	
Consensus: 100% Agree	5	6	5	8	8		6	5	1	6	5	4	9	1	3	1	1	74
Consensus: 70% to less than 100% Agree	12	13	2	8	4	2		1	3			2	3	2	3	8		63
No Consensus																		
Disagree Consensus						1												
Total Statements	17	19	7	16	12	3	6	6	4	6	5	6	12	3	6	9	1	138

Hasil Penelitian Ronde Ketiga

1. Dimensi Kualitas Data dan Informasi Pendidikan Tinggi

Berdasarkan kesepakatan 20 panel pakar pada Ronde ketiga Delphi studi, diperoleh daftar urutan ranking mulai yang dianggap paling penting seperti pada Tabel 23.

Tabel 23. Dimensi Kualitas Data/Informasi (KDI) Pendidikan Tinggi

Dimensi KDI	Respon	Mean Rank	Urutan Rangking
Accessibility	20	1.23	1
Accuracy	20	1.37	2
Timeliness	20	2.04	3
Credibility	20	3.22	4
Coherency	20	3.43	5
Understandability	20	3.78	6
Appropriate amount of data	20	4.00	7
Completeness	20	4.44	8
Security	20	5.33	9
Concise representation	20	5.47	10
Consistent representation	20	6.43	11
Value-added	20	7.46	12
Reputation	20	7.55	13
Relevancy	20	8.06	14
Interpretability	20	9.30	15
Objectivity	20	9.33	16
Free-of –error	20	9.73	17
Ease of manipulation	20	10.07	18

Accessibility	The extent to which data is available, or easily and quickly retrievable
Accuracy	The degree to which the data correctly or reliably estimate or describe the quantities or characteristics that they are designed to measure.
Timeliness	The extent to which data is sufficiently up-to-date for the task at hand
Credeability	The extent to which data is regarded as true and credible
Coherency	The degree to which the data are logically connected and mutually consistent
Understandability	The extent to which data is easily comprehended
Appropriate amount of data	The extent to which the volume of data is appropriate for the task at hand
Completeness	The extent to which data is not missing and is of sufficient breadth and depth for the task at hand
Security	The extent to which access to data is restricted appropriately to maintain its security
Concise representation	The extent to which data is compactly represented
Consistent representation	The extent to which data is presented in the same format
Value-added	The extent to which data is beneficial and provides advantages from its use
Reputation	The extent to which data is highly regarded in terms of its source or content
Relevancy	The extent to which data is applicable and helpful for the task at hand
Interpretability	The extent to which data is interpretable
Objectivity	The extent to which data is unbiased, unprejudiced, and impartial
Free-of –error	The extent to which data is correct and reliable
Ease of manipulation	The extent to which data is easy to manipulate and apply to different tasks

2. Masalah Kualitas Data dan Informasi

Berdasarkan kesepakatan 20 panel pakar pada Ronde ketiga Delphi studi, diperoleh daftar urutan ranking maslah kualitas data dan informasi mulai yang dianggap paling sering terjadi seperti pada Tabel 24, Tabel 25 dan Tabel 26.

a) Perspektif Teknologi

Masalah Teknologi KDI	Respon	Mean Rank	Ranking
System integration	20	3.22	1
Configurability-Deployment	20	3.56	2
Database synchronisation	20	4.22	3
System adoption, implementation and documentation	20	5.17	4
DIQ monitoring/Verification	20	5.33	5
Mobility-Data and services through contextualized and mobile interface	20	6.00	6
Data and services functionality porting to the cloud	20	6.22	7
Use of DIQ enabling tools	20	6.33	8
Support of computing infrastructure resources	20	6.83	9
Data gap between asset maker/provider and asset user	20	8.11	10
User interface	20	8.56	11
Systematic asset description	20	9.11	12
Capability constraint of system	20	10.18	13
Data cleansing	20	10.41	14
Automated data/information capture	20	10.55	15
Autonomous information/communication exchange	20	11.24	16

System integration

In many HE institutions, there are a number of different standard systems and software solution for DIQ that are not optimally interlinked for various tasks in the educational, administrative and managerial process. The silo software/applications created integrated at different levels of Departments and Study programs. As the systems are not integrated, more time, effort and resources wasted in manual double data input.

Configurability-Deployment ease

The speed of having the device ready to operate is an important factor. A quick boot-up time enabling IT opetarors productively use dead times effectively

Database synchronization

The process of establishing data consistency between two or more databases that can be automatically copying changes back and forth. Harmonization of the data across Departments/Study programs over time should be perform continuously. In many HE cases, mostly pulling out data from source (University master) database to destination (Departments/Study programs-Slave) is the sensitive case.

System adoption, implementation and documentation

Mandated decision of top university management or government in IT system adoption and implementation, in many cases not fit (biased technology perception) with the DIQ requirements (HE relevant dimensions). The system does not flexible and conform to the Departments/Study programs. As a result standardization of system documentation might have a negative impact on DIQ.

DIQ monitoring/ verification

DIQ verification techniques essentially involve checking and monitoring that a data value meets some specification, such as being of a required data type, in a specified domain or range, or satisfying some kind of constraint or consistency or others dimensions check. The use of metadata to support verification should make it easier for producers and users to incorporate additional specifications and constraints of these kinds, to be used by automated or semi-automated processes that can verify that data values meet these constraints. In addition, data visualization techniques can be employed to help both data producers and users see patterns in their data, find outliers, and generally use their own subject area expertise to verify that data values appear reasonable.

Mobility- Data and services access through contextualised and mobile interfaces.

Refers to characteristics of device to handle collaborative learning of data and information access, communication in state of motion. Data and service access through particular mobile collaborative learning interface. The mobility of the students/lecturers on a physical environment depends on the features of the physical environment where the students/lecturers are located and the current environmental conditions where more HE institutions have multiple campuses across multiple sites.

Acessible-Data and services functionality porting to the cloud (Cloud service for collaborative facility learning)

The cloud computing platform supporting online interaction, without the intervention of local IT staff, of (but not limited) the following:

- Online/blanded learning
- Learning monitoring/evaluation
- Automatic diagnostic and SWOT analysis of academic health and performance

Use of DIQ tools

The DIQ tool provides functions to detect data errors (redundant/double/duplicate, similar) and correct dirty data. Instead using DIQ tool, a number of HE data indicated that they relied on manual data comparisons to detect data errors. The lack of a useful DIQ tool could be an issue that might have an impact on data quality.

Support of computing infrastructure resources

The university could not improve the quality of data without having infrastructure support (computer resources and network), especially off campus data entry productivity. Another consideration related to computing resources involves the following requirements:

- *Multimedia support.*
  The features of each device limit the quality and quantity of heavy multimedia data/information e.g. audio, video or image that is able to capture, store and transmit. Smaller the device size more limited will be the solution.
- *Portability (transportability)*
  Smaller the mobile device size the more transportable is the device. However, reduce the device size affects constraints at least on the screen size and data/information input capability.
- *Long-time support (battery life)*
  The battery life as critical to support mobile collaboration particularly related to an activity duration. If collaborative learning using PDAs, notebooks or Tablet PCs, they have chance to bring extra batteries.
- *Bar code reader/printer for part check out*
  Bar code reader is used to identify physical asset equipment (asset ID: Books, Computer, Laboratory equipment, etc.) and the actual reporting to input standardized feedback codes.
- *Direct report printing (wired/wireless)*

Data gap between the creator and the users

In HE institutions, the data/information user needs to populate its academic information system with data from the Departments/Study programs particularly the learning materials and administrative rules/policies. Unless arrangements or perception unity conditions are made, some of the data is not passed on to the student in a usable electronic format. In other cases, updated digital format data, particularly the component lecture/practicum materials, may not always be passed on to the class instructor/assistant (users). Information such as registration instructions, course withdraws and advisory notices are also available. However, without standards and interfaces to share this information across systems, it is often held offline — either as paper documents or poorly linked electronic copies of instructions. To be able to have high quality asset information, the data gap between the data creator and data user must be bridged.

User interface

The user interface is that imprecise space where humans as a user interact with a DIQ computer software/system. Many DIQ software/application make frustrating because it's easy to get lost or because the system does not work as expected for at least the following element problems.

- Course Content Tools, help students to prepare for the next classes and strengthen their understanding about the respective courses.
- Communication Tools, such as discussion forums, mail, chat, and whiteboard allow students a lively communication with other learners as well as lecturer/instructor.
- Tools-Assignment Submission, allows students to submit course assignments and receive the feedback from the lecturer or teaching assistants.

Systematic institutional asset description

Standardization of data format for identifying central asset (physical and digital) inventories. The IT crew from different Departments/Study Programs or campus region did not use the same terms in describing DIQ problems or used different terms to refer to the same asset.

Capability constraint of system

The implemented DIQ software/application not support:

- a speed of data display, no matter how much information to look for in several different databases,
- the integrity of the information at all times, even in concurrent data/information access/input/review,
- a high rate of concurrent e-learning transactions as different students/staffs/lecturers may have to enter new information or modify it

Data cleansing

Data cleansing or data cleaning mainly involves identifying and removing errors and inconsistent data in order to improve the quality of the data. Data inconsistencies exist in single data collections, such as files and databases. The main reasons for bad quality of data can be incorrect spellings during data entry, invalid data, missing information, etc.

Data cleansing in HE institutions is an important task. It is important that appropriate data cleansing tools is perceive as a strategy to improve DIQ, then the right data is used, and analysed to make the possible better decision-making.

Automated data/information capture

In HE institutions manual data entry is still alive and clicking. Departments/Study Programs rely on the tedious process of lecturers/students entering data/information from form into

computer systems. They not implemented yet automated data capture.

Automated data capture can signicantly reduce errors when compared to manual entry. As illustration a university professor or assistant having to grade a multiple-choice exam for a class with 100 students. Even with an answer key, the grader must keep track of the number of correct and incorrect answers, then record the overall score – and repeat 99 times. Automated data capture systems can process many forms per minute.

Autonomous information/communication exchange

Autonomous mobile collaborative learning is characterized by periods in which groups of Departments/Study programs work *independently* on a *loosely-shared artefact*. They come together for periods of *tightly-coupled sharing* to *integrate* the disparate work done by collaborators

b) Perspektif Organisasi

Masalah Organisasi KDI	Respon	Mean Rank	Ranking
Clear data/information vision (DIQ strategy-HE Institution leadership)	20	2.06	1
IT (Data) Governance	20	3.50	2
Manual/paper based data acquisition	20	3.83	3
Data access and coordination access across Schools/Department/Study Programs	20	4.78	4
Data integration	20	5.00	5
Cross- Study Programs management communication	20	5.44	6
Large volumes of data (big data)	20	6.33	7
Awareness of organizational implication of new academic information systems	20	6.44	8
Un-Planned/Use of data	20	6.53	9
DIQ policies and support	20	7.22	10
Commitment of senior management	20	7.45	11
Information need analysis	20	2.06	12
Appropriate coordination mechanism of the team	20	3.50	13
Data input control	20	3.83	14
Disparate data/information sources	20	4.78	15
Process evaluation, review/audit	20	5.00	16

Clear data/information vision (DIQ strategy-Institution objective)

HE institutions have to understand the educational process flow and operational perspectives. By defining the critical points and potential problems within the process flow enables to determine, easily, which technology services should be used to alleviate the issue.

IT (Data) Governance

Data Governance is critical both for data quality and to ensure that data is used only for proper purposes. Critical data is now being stored more extensively outside the academic information system and ERP, which means that effective data management and governance needs to be applied wherever this data resides. In order for a university's data analytics implementation to succeed, the HE institution must create policies that address, for instance, what kinds of structured or unstructured data should be handled by whom, and ensure that this usage remains in compliance with internal, Ministry and other Government regulations.

Implementation requires cooperation across departments and users, and should mandate that only properly trained users can access and manage data relevant to their role. Effective data governance creates cross-departmental responsibility and accountability to ensure best practices and cross-enterprise sharing of data and insights.

Manual/paper based data acquisition

The use of paper-based data collection is still common in HE institutions due in part to its portability and independence of technology. Service job sheets are a common example for collecting paper-based data. It was perceived that manual paper-based data collection might increase the likelihood of human error and cause data quality problems. HE Stakeholders indicated the possible reasons why manual paper-based data collection might cause data quality problems. For example, a non-IT admin/operator may record less data on paper for the purpose of reducing the workload of data entry later when they meet IT crew or operator.

Despite the standard forms for recording academic/administrative data being in place in a University, the lack of enforcement in using standard forms to record data was perceived to be an issue causing data quality problems. The details of data to be recorded are left to the individual technician to decide. This might increase the likelihood of creating inconsistent, incomplete data within and across Departments.

Data access and coordination access across Schools/Department/Study Programs

Coordinating data can be difficult because the data come from several different Departments and from different sources within the Schools/Departments/Study Programs. Poor coordination of data across Departments was perceived to be an important issue that might cause HE DIQ problems. Consequently, IT operators create their own silos of information and kept them locally. In addition, data/information needed are not readily available to all because they are not integrated into academic information systems. Without well-defined processes for data coordination across departments, administrative staff, for example relied on informal processes or personal relationships to access and transfer information.

Data integration

As data generated from multiple sources, application and working on it has become the flagship of some forms, template, etc. by many HE institutions. The need to integrate and access disparate information sources in consistent, trusted and reusable ways has become critical as today's HE Institutions extend their boundaries globally. Integrating and accessing academic/educational data can be difficult because the data often come from external (government, contractors, suppliers), which is only passed on to some Departments in a paper-based format. Without integrating the data into the main academic information systems, the usefulness of such data is limited.

Cross- Study Programs management communication

At the Study Programs level, cross-management communication is essential. Collaboration can lead to the identification and generation of data and information related emerging knowledge, scaling the added value of the individual data/information findings. Very often these findings may provide a valuable insight or perspective for middle and higher management level tasks with very short time window.

Large volumes of data (big data)

Large volumes of data (big data) were found to have an impact on asset information quality. Big collected data might create potential problems for data entry and increase the likelihood of degradation of the quality of data entered. More information is not necessarily better. Creating a permanent solution to the data volume problem requires proactive analysis of what data is needed to provide effective and valuable learning productive. The solution is only as effective as the analysis of which data is important to save.

Awareness of institutional implication of new academic information systems

The likely future implications of new academic information system in terms of institutional outcomes within the HE institutions, including implications for new skills requirements, role changes, impacts upon staffs/lecturers/students, remote campus and HE institutional structures. It's therefore, all internal HE stakeholders have to have a basic understanding of a new adopted/implemented systems.

Un-planned/Use of data

While HE institutions need complete and accurate data for decision-making, they also need to balance data use with data collection. In fact, HE institutions may fall prey to data overload—collecting more data than they can possibly use (un-planning). Consequently, data might leave the data quality problems undetected, and miss the chance to improve data quality in an earlier stage. Moreover, a longer time lag exists in using the collected

data, which reduces the chance to detect and correct the quality problems with the collected data.

DIQ policies and support

University Management must treat data quality problems with high priority. It is the responsibilities of management to develop an institutional DIQ policy and establish a DIQ system that applies to all phases of the production of data products. Management commitment in initiating DIQ program and IT governance, allocating resources to DIQ projects, providing training to raise data quality awareness, and implementing incentive systems that reward DIQ improvements is to maintain continuous DIQ improvement.

Commitment of senior management

The actions and supports from the commitment of senior management are important to have a positive impact on the data quality. It was found that disconnects existed between senior management and operational workers. The senior management did not take into account the concerns of the people at the bottom. Disconnects between senior management and IT crew is believed to be an important aspect for data quality in HE institutions.

Information need analysis

Without having a clear understanding why the data needs to be collected and the use of such collected data, how can data collectors decide which is the right data to be collected? It was believed that a clear understanding of the data requirements might help produce right data and have a positive impact on the data quality.

To help better identify the needs for data, a number of HE institutions in developed countries indicated a clear understanding of DIQ key performance indicator (KPI) from Vice Chancellor is essential, because it provides a good guidance on what data needs to be collected.

Appropriate coordination mechanism of the team

The academic information system should provide prioritised direct links, so that when needed, IT operator across Study Progrsms can prompt to the low/midle/high managers and vice-verce. Regular meeting (at least weekly or bi-monthly) will develop rapport and sharing of information and exchange of ideas, especially within the data creators.

Data input control

The data input control is important, because the most important quality control should be at the input stage when the data is entered. The process for data entry should be

controlled and reviewed in a careful manner. The data input have to be very structured process for getting the DIQ into the academic information system.

Disparate data/information sources

In HE institution, there are so many data/information sources: students, lecturers, staffs, managements, study programs/departments/schools, etc., that HE institutions must deal with a complicated and diversity of data sources. Disparate sources of data were perceived to be an issue that might cause data access problems. Integrated DIQ dimensions will enable us to correlate, connect and integrate these disparate data sources to help increase the level of confidence of decision-making.

Process evaluation, review/audit

Specialised academic information/management systems are often built with a pre-determined academic business process methodology that requires a rigid business structure for it in order to work successfully. They are only as effective as the processes in which they operate. Placed faith in academic information system without reengineering their processes to fit the system requirements results in adverse impacts on the quality of its data.

c) Perspektif Personal

Masalah Pengguna KDI	Respon	Mean Rank	Ranking
Craft skill and training	20	1.61	1
Personal competency and experience	20	3.00	2
Teamwork and Informal social communication between personnel	20	3.22	3
Data stewardship	20	3.33	4
Disconnect among data stakeholders	20	3.89	5
Performance evaluation and motivation	20	5.94	6

Skill and training (technology competence)

It is clear that education and training can provide staff members with a better way to learn new things and get knowledge to handle the system and perform their work, therefore producing reliable data. On the other hand, the lack of appropriate education and training can cause serious problems for a University by having an adverse impact on DIQ.

Skilled people recruited will make a group of motivated IT crew working well, and people need appropriate training to be able to produce high quality data. However, education and training are only infrequently addressed in real world practice. A whole range of training is necessary and expectations in training should be reasonable.

Personal Competency and Experience

Relying on past personal experience was an issue that might impact on data quality. When there is a lot of unknowns or lack of information, people tend to rely on personal judgement and past experience to do their work, therefore producing unreliable data.

There is a lot of an unknown attached to every steps of data collection, processing, saving, analysing and distributing. An IT crew has to do a risk assessment, and He/She really rely back on His/Her past experience when it comes to answering some questions (problems).

Teamwork and Informal social communication between IT personal

Teamwork is important to produce high quality data in the HE institutions. Some Universities had difficulty in collecting sufficient data. It faced a lot of unknowns (trust operator involving in: their integrity and skill level etc.) and had to rely on using incomplete verbal information for academic/administrative decisions. Informal social communication enable act as a-user maintained direct link that can instantly facilitate the collaborative handling of alerts and unexpected events in order to collect, process and ensure the quality of data and information is ready to be accessed.

Data stewardship

Having a data quality manager would make a positive difference in data quality. It is believed that the lack of a data quality manager's position to manage DIQ-related problems might impact on data quality. Data quality manager responsible for keeping data integrity in swapping information from Study Programs to Departments/Schools and vice versa, and to make sure that the data is consistent.

Disconnect among Data Stakeholders

Awareness of DIQ importance could be a big gap between the high level of data user, data owner and the low level of data collector and data custodian in relation to their confidence in the quality of the data they used in their University. This confidence gap indicated that not only there is a disconnection between the strategic level decision makers and the operational level data processors, but also there must be DIQ problems in HE institutions. The gap of DIQ stakeholder is awareness of an understanding of different stakeholder viewpoints and any biases and other cultural and political issues involved related to the importance of HE data production in every levels (Study Programs/Departments/Schools).

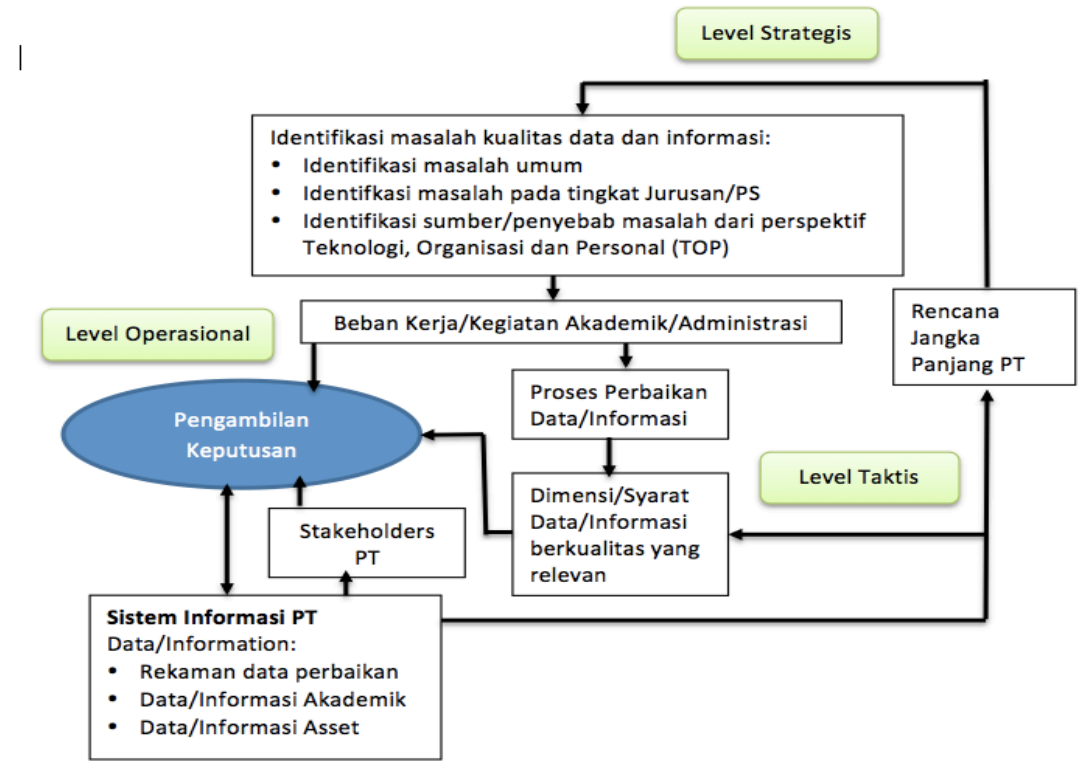
Performance evaluation and motivation

HE Institutions are different from many businesses where separate personnel are engaged for data entry who are skilled and trained for their job. In Universities, the task of data entry would normally be done by operators whose primary job is to operate and maintain Study Program and who are also expected to perform the job of entering data. Consequently, they need an extra effort and motivation (as they do an extra job) for data collection to avoid a negative impact on data quality.

Making the job simpler and easier, as well as having the data collectors get benefits from the data they captured and entered could achieve motivation for data collection.

Framework Perbaikan/peningkatan Kulitas Data dan Informasi Pendidikan Tinggi

Strategi perbaikan atau pengembangan kualitas data dan informasi dilingkungan PT dilakukan berdasarkan rencana jangka panjang PT atau Universitas tertentu. Rencana jangka panjang PT didasarkan pada visi dan misi yang jelas dan terukur serta dapat diwujudkan. Untuk mencapai visi tersebut, peranan data dan informasi yang berkualitas merupakan suatu tuntutan yang dibutuhkan pada tiga level terstruktur yang terdiri dari Level Strategis, Level Taktis dan Level Operasional. Gambar 1 adalah Framework Perbaikan Kualitas Data dan Informasi yang mengilustrasikan hubungan antara proses perbaikan kualitas data dan informasi dan tiga level rangkaian tindakan terstruktur menuju pengambilan keputusan yang tepat.



Gambar 1. Framework Perbaikan Kualitas Data dan Informasi

Pada level **Strategis,** data dan informasi yang berkualitas ditempatkan sebagai salah satu prioritas pada rencana strategis baik jangka pendek, menengah dan panjang. Proses transformasi dilakukan dengan dukungan penempatan ahli IT dalam periode tertentu untuk mengatasi masalah kualitas data/informasi dan / atau tindakan atau strategi perbaikannya. Identifikas masalah kualitas data dan informasi berikut rencana strategis secara umum untuk perbaikan (jangka pendek, menengah dan panjang) akan diperoleh pada level strategis ini. Dalam membuat keputusan strategis, referensi dari visi institusi, dan usulan dari ahli IT serta studi tentang kinerja historis institusi diperlukan sangat diperlukan.

Pada level **Taktis,** seluruh sumberdaya (ahli IT, aplikasi/software dll.) untuk perbaikan beserta deskripsi urutan proses perbaikan dan pengujian dilakukan. Pada level ini, program kerja terperinci yang terdiri dari tugas-tugas khusus dan sumber daya yang dialokasikan sudah tersedia dan terdokumentasi. Level Taktis ini akan memungkinkan pimpinan (Universitas, Fakultas, Jurusan), perencana, dan ahli IT/operator/teknisi untuk memiliki akses ke semua data/Informasi. Data bermasalah diubah menjadi informasi yang akan digunakan untuk memprioritaskan tindakan akademik/administrasi/pengelolaan dan pengambilan keputusan yang strategis pada level Operasional.

Pada level **Operasional**, tugas perbaikan kualitas data dan informasi akan dilakukan secara akurat oleh ahli IT yang terampil, dalam waktu yang telah dialokasikan, mengikuti prosedur yang benar, dan menggunakan aplikasi/software yang sesuai. Prosedur perbaikan atau pemulihan kualitas data dan informasi baik yang bersifat pencegahan maupun perbaikan data yang tidak sesuai syarat/dimensi kualitas data dan informasi yang relevan dilakukan. Semua tugas perbaikan akan diselesaikan dan data yang bersisi riwayat, prosedur perbaikan akan dicatat dalam system informasi pada level ini.

Dengan mengikuti Framework manajemen terpadu perbaikan data dan informasi PT pada tiga level diatas, dan mengadaptasi cara identifikasi dan cara perbaikan yang telah diuraikan sebelumnya, institusi PT akan mencapai sistem manajemen perbaikan data dan informasi yang secara otomatis beradaptasi dengan teknologi dan tujuan institusi yang terus berubah.

Seperti dapat dilihat pada Gambar 1 di atas, tiga aktivitas yang terintegrasi dalam proses perbaikan jelas striktur dan hubungannya antara satu level dengan level yang lainnya. Untuk menyederhanakan proses identifikasi dan perbaikan data dan informasi, menurut rekomendasi 20 pakar kualitas data dan informasi dari 10 negara. Mereka berpendapat bahwa:

- Urutan mengidentifikasi beberapa masalah kualitas data dan informasi dari paling umum sampai yang khusus. Data disimpan terpusat pada masing-masing program studi (PS), Jurusan dan Fakultas. Seperti halnya proses entri data secara manual tidak efisien, lambat dan rawan kesalahan. Peran pengelolaan data tidak didefinisikan dengan jelas, dan adanya kekurangan komunikasi antara pengelola data tersebut. Semua masalah ini berkontribusi pada ketidakakuratan dalam data dan ketidakmampuan untuk memonitor data dengan baik serta informasi untuk kualitas.
- Pada umumnya, PT memiliki masalah kualitas data dan informasi yang serupa. Data dan informasi pada umumnya tidak lengkap dan tidak up to date dan cenderung terpusat. Masalah kualitas ini terutama terjadi pada tingkat PS sebagai penyedia data utama. Hal ini dapat mengakibatkan inefisiensi operasional, ketidakmampuan untuk memahami masalah dan meningkatkan kualitas mahasiswa, dan bahkan bisa menyebabkan kegagalan untuk

mengidentifikasi mahasiswa yang berisiko drop out dan membutuhkan bantuan dini yang sesuai.

- Strategi perbaikan atau peningkatan kualitas data yang efektif dimulai dengan kolaborasi antara pembuat data (PS) dan pengguna akhir untuk menunjukkan akar penyebab masalah kualitas. Dengan cara ini, masalah-masalah ini dapat diperbaiki ketika data dibuat (operator/TI) untuk diperbaiki segera. Untuk perbaikan kualitas data dan informasi, institusi PT harus bekerja untuk meningkatkan kualitas data pada saat pembuatan. Kalau perbaikan dilakukan saat pembuatan atau penyusunan, paling tidak masalah timeliness atau tidak terjadi. Oleh karena itu data harus menjadi tanggung jawab bembuat dan penyusun.
- Menggabungkan semua data ke dalam sistem terpusat pada tingkat Universitas. Tanpa menyepelekan sumbernya, data diintegrasikan dan divalidasi menggunakan algoritma pencocokan dengan software untuk menghilangkan duplikasi data. Semua data kemudian dapat dikelola melalui system informasi PT. Jika dianggap perlu (karena masalah big data) database dapat dikirim ke cloud yang bias diakses oleh seluruh pengguna baik dalam maupun luar kampus kapan pun diperlukan.

D. **STATUS LUARAN**: Tuliskan jenis, identitas dan status ketercapaian setiap luaran wajib dan luaran tambahan (jika ada) yang dijanjikan. Jenis luaran dapat berupa publikasi, perolehan kekayaan intelektual, hasil pengujian atau luaran lainnya yang telah dijanjikan pada proposal. Uraian status luaran harus didukung dengan bukti kemajuan ketercapaian luaran sesuai dengan luaran yang dijanjikan. Lengkapi isian jenis luaran yang dijanjikan serta mengunggah bukti dokumen ketercapaian luaran wajib dan luaran tambahan melalui Simlitabmas.

1. Luaran Wajib: Framework

Kategori Luaran	Jenis Luaran	Status	Tahun	Bukti Luaran	Keterangan
Framework	Framework Strategi perbaikan atau peningkatan kualitas data dan informasi dilingkungan PT dengan mengintegrasikan antara Rencana jangka panjang PT dengan 3 level terstruktur yang terdiri dari Strategis, Taktis dan Operasional. menuju pengambilan keputusan yang tepat.	Ada/ Tersedia	1	Framework terintegrasi beserta deskripsi prinsip kerja terstruktur dan strategi perbaikan kualitas data dan informasi	Framework dibuat berdasarkan analisa data dan rekomendasi dari panel Delphi studi (penelitian tahun pertama)

2. Luaran Tambahan

a) Artikel yang dipublikasikan pada Jurnal Internasional bereputasi

Kategori Luaran	Jenis Luaran	Status	Tahun	Bukti Luaran	Keterangan
Publikasi di Jurnal Internasional	**Artikel di Jurnal Internasional ber ISSN dan terindex Scopus (Q2)**	submitted	1	• Surat keterangan submitted dari Jurnal (Chief Editor) • Preprint artikel	Nama jurnal: Education and Information Technologies Penerbit: Springer New York LLC ISSN: 1360-2357 Judul artikel: International Consensus on Data and Information Quality for a Better Quality of Decision in Higher Education Institutions

b) Artikel yang dipublikasikan pada Konferensi Internasional

Kategori Luaran	Jenis Luaran	Status	Tahun	Bukti Luaran	Keterangan
Publikasi di Seminar Internasional	**Artikel di Seminar Internasional ber ISBN dan terindex Scopus**	Published	1	• Cover • Daftar isi • Editor/panitia • Artikel	Nama konferensi: The 33rd IBIMA conference Waktu pelaksanaan: 10-11 April 2019, Granada, Spain Judul artikel: Data and Information Quality Framework Development: Proposed for Indonesia Higher Education Nama penulis: Halimah Husain, Faisal Syafar, Edy Sabara URL: https://ibima.org/accepted-paper/data-and-information-quality-framework-development-proposed-for-indonesia-higher-education/ Lembaga pengindeks: Scopus, Clarivate Analytic, ISI Proceedings, Elsevier, Engineering Village

c) Buku Ajar

Kategori Luaran	Jenis Luaran	Status	Tahun	Bukti Luaran	Keterangan
Buku Ajar	**Buku Ajar ber ISBN**	Draft	1	• Cover • Daftar isi • Bab 1 • Bab 2	Nama Buku Ajar: Big Data dan Cloud Computing Nama penulis: Faisal Syafar, Halimah Husain Edy Sabara Lembaga penerbit: akan diterbitkan oleh Lembaga penerbit UNM

E. **PERAN MITRA:** Tuliskan realisasi kerjasama dan kontribusi Mitra baik *in-kind* maupun *in-cash* (untuk Penelitian Terapan, Penelitian Pengembangan, PTUPT, PPUPT serta KRUPT). Bukti pendukung realisasi kerjasama dan realisasi kontribusi mitra dilaporkan sesuai dengan kondisi yang sebenarnya. Bukti dokumen realisasi kerjasama dengan Mitra diunggah melalui Simlitabmas.

Mitra penelitian, Institut Sains dan Teknologi Pembangunan Indonesia (IST-PI) Makassar, menugaskan salah satu staf dosen luar biasa, sdr. Firman, S.Pd., M.Pd. untuk mendampingi dan mensupport penelitian tahun pertama ini mulai perumusan draft kuesioner, analisa data sampai pada verifikasi Framework.

F. **KENDALA PELAKSANAAN PENELITIAN**: Tuliskan kesulitan atau hambatan yang dihadapi selama melakukan penelitian dan mencapai luaran yang dijanjikan, termasuk penjelasan jika pelaksanaan penelitian dan luaran penelitian tidak sesuai dengan yang direncanakan atau dijanjikan.

1. Kendala Pelaksanaan Penelitian: Karena seluruh responden penelitian (panel Demphi Studi) yang berjumlah 21 (yang bersedia dari awal) berasal dari 10 negara yang berbeda, kami mengalami hambatan dalam hal: (1) distribusi kuesioer (online atau via email). Karena lebih banyak yang memilih via E-mail, maka kami harus mengkonversi dokumen pertanyaan berupa file XML yang memudahkan mereka memilih jawaban yang dianggap tepat, mirip versi online; (2) Beberapa diantara panel Delphi

studi terlambat mengembalikan jawaban, sehingga kami dengan terpaksa harus mengirimkan reminder.

2. Kendala Luaran Penelitian: (1) Kami hanya terkendala waktu tunggu untuk status artikel yang dikirim untuk Jurnal internasional bereputasi yang menurut catatan jurnal tersebut, kami butuh menunggu 76 hari untuk menerima keputusan pertama mereka. Kami merasa tidak punya jalan keluar (solusi) untuk masalah ini.

G. **RENCANA TAHAPAN SELANJUTNYA:** Tuliskan dan uraikan rencana penelitian di tahun berikutnya berdasarkan indikator luaran yang telah dicapai, rencana realisasi luaran wajib yang dijanjikan dan tambahan (jika ada) di tahun berikutnya serta *roadmap* penelitian keseluruhan. Pada bagian ini diperbolehkan untuk melengkapi penjelasan dari setiap tahapan dalam metoda yang akan direncanakan termasuk jadwal berkaitan dengan strategi untuk mencapai luaran seperti yang telah dijanjikan dalam proposal. Jika diperlukan, penjelasan dapat juga dilengkapi dengan gambar, tabel, diagram, serta pustaka yang relevan. Jika laporan kemajuan merupakan laporan pelaksanaan tahun terakhir, pada bagian ini dapat dituliskan rencana penyelesaian target yang belum tercapai.

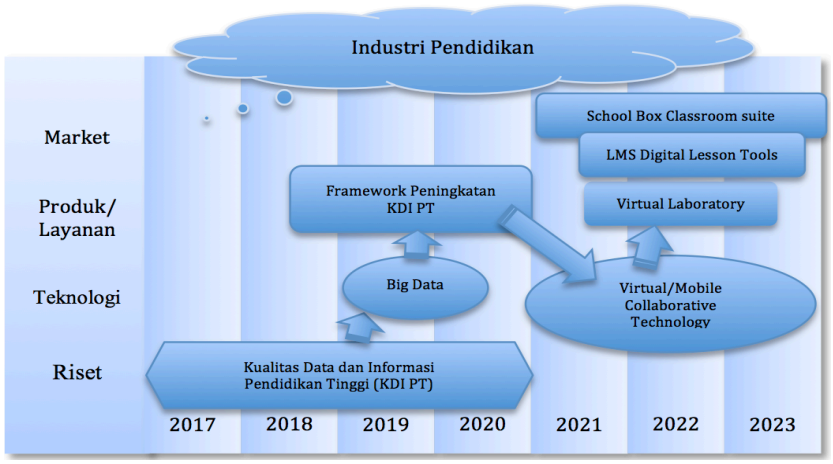
Road Map Penelitian

Status kegiatan penelitian yang diusulkan oleh ketua beserta anggota tim merupakan pengembangan dari penelitian-penelitian yang telah dilaksanakan pada tahun-tahun sebelumnya. Kegiatan yang dimaksud adalah pengembangan dari kegiatan akademik seperti:

1) Melakukan **penelitian** tentang: Analisis kualitas data di Fakultas Teknik UNM (2016-2017); Penerapan *remote access* pada jaringan komputer perusahaan; Analisa kualitas layanan trafik multimedia pada jaringan DiffServ Perusahaan (2006); Pengembangan jaringan *telemedicine* untuk peningkatan kualitas data kesehatan berbasis Puskesmas (2005);
2) **Menyajikan makalah** pada forum-forum ilmiah baik secara nasional maupun internasional berkaitan dengan Framework Kualitas Data dan Informasi perusahaan pengelola asset fisik di berbagai negara;
3) Melakukan kegiatan **workshop/pelatihan** pada industri mengenai *Data Quality* dan *Mobile Information quality content* di berbagai Negara;
4) Mulai tahun 1996 sampai dengan sekarang (termasuk pada saat studi S2 dan S3 di luar negeri, menjadi sessasional lecturer) **mengajarkan** mata kuliah Pengolahan Data Citra Satelit, Sistim Basis Data, Sistem Analisis IT, Big Data dan Cloud Computing, Sistem Telekomunikasi Bergerak, dan Jaringan Telekomunikasi Multimedia.

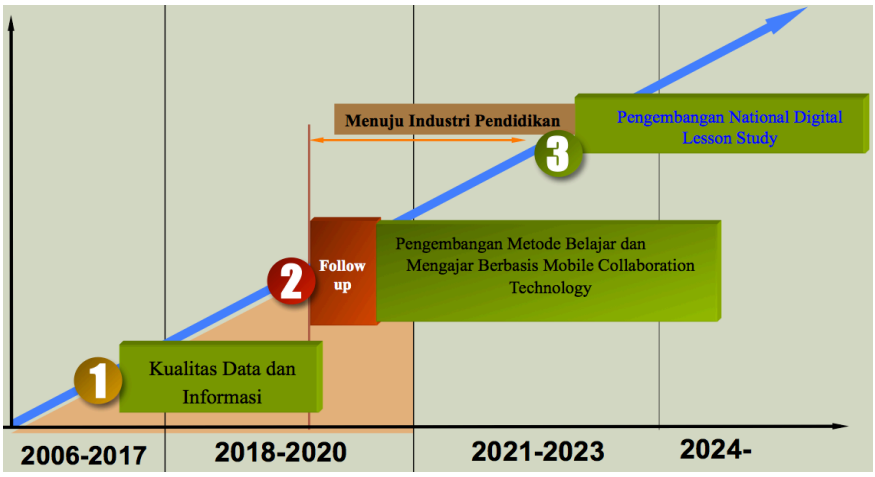
Pada tahun 2015 ketua pengusul menyelesaikan program Doktor pada University of South Australia, dengan judul disertasi berkaitan dengan Framework penerapan teknologi mobile collaboration pada industri rekayasa dengan judul *Mobile collaboration technology implementation framework in engineering asset organisations*. Penelitian ini menghasilkan 11 paper (jurnal, book chapter, prosiding) yang sudah publish. Delapan diantaranya terindeks Scopus. Karya ilmiah relevan lainnya adalah melakukan publikasi pada jurnal internasional dengan judul "*Building a framework for improving mobile collaborative maintenance in engineering asset organizations*" dan "*The Success Implementation Factors for Mobile Collaboration Technology in Asset Maintenance*, diterbitkan pada Journal of Mobile Technologies, Knowledge & Society, masing-masing pada tahun 2013 dan 2015. Selanjutnya paper dengan judul "*Development of an Integrated Framework for Successful Adoption and Implementation of Mobile Collaboration Technology in Healthcare*", Journal of e-Health Management, tahun 2016. Ketiga jurnal tersebut terindex oleh Ebsco dan Proquest. Selanjutnya peta

jalan (road map) penelitian pengusul dapat dilihat pada Gambar 1.



Gambar 1. Road Map Penelitian Pengusul

Produk penelitian berupa Framework peningkatan KDI PT ini berpotensi untuk menjadi acuan untuk penelitian pengembangan lanjutan, salah satu diantaranya yang direncanakan adalah Pengembangan Metode Pembelajaran Menggunakan Mobile Learning untuk Pendidikan Tinggi. Sedangkan rencana pengembangan jangka panjang ditunjukkan oleh Gambar 2, dibawah ini.



Gambar 2. Rencana pengembangan penelitian jangka panjang

Tahap kedua (Tahun kedua, 2020), Survei nasional.

Tujuan dari survei nasional adalah untuk:

- menjawab pertanyaan-pertanyaan penelitian khususnya pertanyaan pertama, kedua dan ketiga, yaitu:
- mengungkapkan keadaan terkini tentang KDI PT di Indonesia;
- memahami persepsi secara umum terhadap kualitas data dan informasi yang terkait dengan manajemen sumberdaya PT;

- menverifikasi temuan penelitian tahap pertama (Delphi studi, tahun 2019) yang telah selesai dilaksanakan.
- memberikan gambaran tentang faktor-faktor yang berdampak pada KDI, yang nantinya akan diverifikasi oleh temuan yang diperoleh pada studi kasus di tahap penelitian selanjutnya.

Pada tahap ini paling sedikit 1000 responden akan dikirimkan link kuesioner (online) dan atau melalui lampiran surat elektronik (Email). Adapun peran/posisi target responden adalah:

- unsur operator dan/atau pengelola sistem informasi (SI) di PT (SIA, LMS, SI manajemen asset dll),
- Pengumpul Data, dan Operator IT pada tingkat program studi, jurusan, fakultas dan universitas
- Teknisi yang bertugas dan bertanggungjawab pada pengelolaan dan maintenance data pada tingkat program studi, jurusan, fakultas dan universitas

Populasi dari survey ini adalah institusi perguruan Tinggi Negeri Maupun Swasta (Universitas, Institut, Sekolah Tinggi, Akademi) yang tersebar pada semua pulau besar di Indonesia (Sumatra, Jawa, Bali, Kalimantan, Sulawesi, Maluku dan Papua).

Analisa Data Survei Nasional: Program SPSS akan digunakan untuk analisa data survey meliputi ANOVA (individual variable masing-masing katagori PT); MANOVA (kombinasi dari ke 6 masalah dasar KDI accuracy, completeness, redundancy, integrity, consistency, timeliness) diikuti dengan Multiple Regresi; dan t-test (untuk melihat apakah terdapat perbedaan pendapat yang signifikan dari responden).

Proses dan luaran penelitian tahun kedua digambarkan melalui bagan alir penelitian (*fishbone* diagram) dibawah.

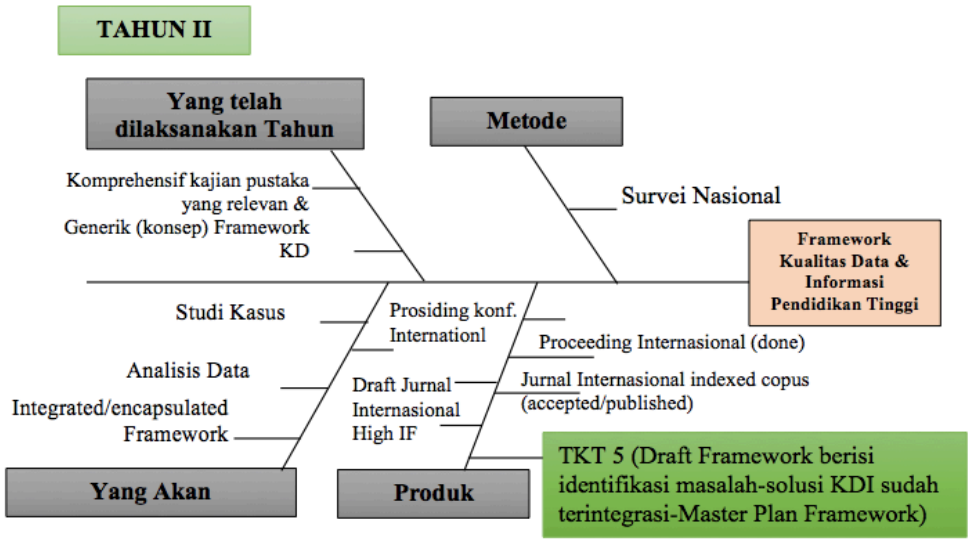


Diagram Alir fishbone Tahun Kedua

Sesuai yang dijanjikan pada proposal Luaran penelitian pada tahun kedua adalah:

1. Luaran Wajib berupa Framework kualitas data dan informasi pendidikan tinggi yang diperoleh berdasarkan analisa data dan rekomendasi survey Nasional.
2. Luaran tambahan berupa:
   a) Jurnal Internasional bereputasi dengan status accepted atau published
   b) Proseding konferensi internasional dengan status published
   c) Paten Framework kualitas data dan informasi PT dengan status draft
   d) Buku ajar " Big Data dan Cloud Computing" dengan status editing

Jadwal Penelitian

No	Kegiatan	Tahun 1												Tahun 2												Tahun 3											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	Kajian pustaka terfokus																																				
2	Analisis kebutuhan																																				
3	Delpi study																																				
4	Pengembangan Framework generik																																				
5	Survei Nasional																																				
6	Wawancara (studi kasus)																																				
7	Analisa Data (Delpi,Survei,Studi Kasus)																																				
8	Pengembangan Framework dan Manual book																																				
9	Verifikasi Framework dan Manual book																																				
10	Perbaikan Framework dan Manual book																																				
11	Seminar hasil penelitian																																				
12	Pembuatan paper-pelaksanaan konferensi internasional																																				
13	Pembuatan artikel dan publikasi ke jurnal internasional																																				
14	Pembuatan Draft-Daftar PATEN/HKI																																				
15	Pendaftaran hasil invensi PATEN/HKI																																				
16	Buku Ajar (draf-editing-terbit/ISBN)																																				
17	Diseminasi/invited speaker																																				
18	Pembuatan laporan Akhir																																				

H. DAFTAR PUSTAKA: Penyusunan Daftar Pustaka berdasarkan sistem nomor sesuai dengan urutan pengutipan. Hanya pustaka yang disitasi pada laporan kemajuan yang dicantumkan dalam Daftar Pustaka.

1. Duffield, C 1993,'The Delphi technique: a comparison of results using two expert panels', *International Journal of Nursing Studies,* vol. 30, no. 3, pp. 227-237.
2. Keeney, S, Hasson, F & McKenna, H 2006,'Consulting the oracle: ten lessons from using the Delphi technique in nursing research', *Methodological Issues in Nursing Research,* vol. 53, no. 2, pp. 205-12.
3. Linstone, HA & Turoff, M 1975, *The Delphi method: Techniques and applications*, Addison-Wesley, Reading, MA.
4. Loughlin, K & Moore, L 1979,'Using delphi to achieve congruent objectives and activities in a paediatrics department', *Journal of Medical Education*, vol. 54, no. 2, pp. 101-106.
5. Sumsion, T 1998,'The Delphi technique: an adaptive research tool', *British Journal of Occupational Therapy*, vol. 61, no. 4, pp. 153-156.
6. Green, B, Jones, M, Hughes, D & Williams, A 1999, 'Applying the Delphi technique in a study of GP's information requirements', *Health and Social Care in the Community*, vol. 7, no. 3, pp. 198-205.

Lampiran 1:

Analisis Statistik Data Delphi Ronde II

Kualitas Data/Informasi (KDI) Pendidikan Tinggi

Dimensi KDI	Delphi Ronde II (N=20)				
	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
Accessibility	21 (100)	-	-	3.0	0
Appropriate amount of data	20 (95)	1 (5)	-	2.95	0.21
Believability	21 (100)	-	-	3.0	0
Accuracy	21 (100)	-	-	3.0	0
Completeness	21 (100)	-	-	3.0	0
Concise representation	19 (90)	2 (10)	-	2.9	0.29
Consistent representation	21 (100)	-	-	3.0	0
Ease of manipulation	18 (86)	3 (14)	-	2.86	0.35
Free-of –error	19 (90)	2 (10)	-	2.9	0.29
Interpretability	19 (90)	2 (10)	-	2.9	0.29
Objectivity	20 (95)	1 (5)	-	2.95	0.21
Relevancy	21 (100)	-	-	3.0	0
Reputation	19 (90)	2 (10)	-	2.9	0.29
Security	21 (100)	-	-	3.0	0
Timeliness	21 (100)	-	-	3.0	0
Understandability	21 (100)	-	-	3.0	0
Value-added	18 (85)	3 (15)	-	2.86	0.35

Masalah Kualitas Data dan Informasi (Perspektif Teknologi)

Delphi Ronde II (N=20)					
Masalah Teknologi KDI	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. System integration	21 (100)	-	-	3.0	0
2. Mobility-Data and services through contextualized and mobile interface	20 (95)	1 (5)	-	2.95	0.21
3. Data and services functionality porting to the cloud	19 (90)	2 (10)	-	2.9	0.29
4. Autonomous information/communication exchange	19 (90)	2 (10)	-	2.9	0.29
5. Configurability-Deployment	21 (100)	-	-	3.0	0
6. Database synchronisation	21 (100)	-	-	3.0	0
7. Support of computing infrastructure resources	20 (95)	1 (5)	-	2.95	0.21
8. Systematic asset description	19 (90)	2 (10)	-	2.9	0.29
9. System adoption, implementation and documentation	21 (100)	-	-	3.0	0
10. Capability constraint of system	19 (90)	2 (10)	-	2.9	0.29
11. User interface	19 (90)	2 (10)	-	2.9	0.29

12. Data cleansing	20 (95)	1 (5)	-	2.95	0.21
13. Use of DIQ enabling tools					
14. Data gap between asset maker/provider and asset user	20 (95)	1 (5)	-	2.95	0.21
15. Automated data/information capture	19 (90)	2 (10)	-	2.9	0.29
16. DIQ monitoring	19 (90)	2 (10)	-	2.9	0.29
17. DIQ verification	21 (100)	-	-	3.0	0

16 dan 17 disatukan pada Ronde III atas permintaan Respondent

Masalah Kualitas Data dan Informasi (Perspektif Organisasi)

Delphi Ronde II (N=20)					
Masalah Organisasi KDI	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. Cross- Study Programs management communication	20 (95)	1 (5)	-	2.95	0.21
2. Appropriate coordination mechanism of the team	20 (95)	1 (5)	-	2.95	0.21
3. Data input control	21 (100)	-	-	3.0	0
4. Disparate data/information sources	19 (90)	2 (10)	-	2.9	0.29
5. Clear data/information vision (DIQ strategy-Institution objective)	21 (100)	-	-	3.0	0
6. Data integration	21 (100)	-	-	3.0	0
7. Use of data	19 (90)	2 (10)	-	2.9	0.29
8. Awareness of organizational implication of new academic information systems	20 (95)	1 (5)	-	2.95	0.21
9. Large volumes of data (big data)	19 (90)	2 (10)	-	2.9	0.29
10. Institutional structure	18 (85)	3 (15)	-	2.86	0.35
11. IT Governance	21 (100)	-	-	3.0	0
12. Manual/paper based data acquisition	21 (100)	-	-	3.0	0
13. Information supplier's quality management	19 (90)	2 (10)	-	2.9	0.29
14. Information need analysis	19 (90)	2 (10)	-	2.9	0.29
15. Unfocus data collection					
16. Data access and coordination access across Schools/Department/Study Programs	21 (100)	-	-	3.0	0
17. Commitment of senior management	18 (85)	3 (15)	-	2.86	0.35
18. Process evaluation, review/audit	20 (95)	1 (5)	-	2.95	0.21
19. DIQ policies and support	19 (90)	2 (10)	-	2.9	0.29

7 dan 14 disatukan pada Ronde III atas permintaan Respondent
12 dan 13 disatukan pada Ronde III atas permintaan Respondent

Masalah Kualitas Data dan Informasi (Perspektif Pengguna/Individu)

Delphi Ronde II (N=20)					
Masalah Pengguna KDI	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. Informal social communication between personnel	19 (90)	2 (10)	-	2.9	0.29
2. Craft skill and training	21 (100)	-	-	3.0	0
3. Personal competency and experience	20 (95)	1 (5)	-	2.95	0.21
4. Data stewardship	21 (100)	-	-	3.0	0
5. Disconnect among data stakeholders	21 (100)	-	-	3.0	0
6. Teamwork	21 (100)	-	-	3.0	0
7. Performance evaluation and motivation	21 (100)	-	-	3.0	0

1 dan 6 disatukan pada Ronde III atas permintaan Respondent

Masalah dan Faktor Penyebab Masalah KDI (Perspektif Teknologi)

Delphi Ronde II (N=20)						
Masalah Teknologi KDI	**Faktor Penyebab**	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. System integration	*System integration*	21 (100)	-	-	3.0	0
2. Mobility-Data and services through contextualized and mobile interface	*Software (features choose)*	20 (95)	1 (5)	-	2.95	0.21
	Mobility of data and services access	21 (100)	-	-	3.0	0
	Mobility of data/information collector	20 (95)	1 (5)	-	2.95	0.21
3. Data and services functionality porting to the cloud	*System adoption/implemented*	19 (90)	2 (10)	-	2.9	0.29
	Accessibility of big data	20 (95)	1 (5)	-	2.95	0.21
	Online interaction	19 (90)	2 (10)	-	2.9	0.29
4. Autonomous information/communication exchange	*System adoption/implemented*	19 (90)	2 (10)	-	2.9	0.29
	Mobile collaboration	20 (95)	1 (5)	-	2.95	0.21
5. Configurability-Deployment	*Interoperability*	21 (100)	-	-	3.0	0
	Speed readiness of devices/tools	21 (100)	-	-	3.0	0
6. Database synchronisation	*Database synchronization*	21 (100)	-	-	3.0	0
7. Support of computing infrastructure resources	*Support of sufficient computing resources*	20 (95)	1 (5)	-	2.95	0.21
	Infrastructure support	20 (95)	1 (5)	-	2.95	0.21
8. Systematic asset description		19 (90)	2 (10)	-	2.9	0.29
9. System adoption, implementation and documentation	*Adoption of IT systems*	21 (100)	-	-	3.0	0
	System implementation	21 (100)	-	-	3.0	0
	Use multiple versions of software	21 (100)	-	-	3.0	0
	Standardization of system documentation	20 (95)	1 (5)	-	2.95	0.21
10. Capability constraint of system	*System constraint*	19 (90)	2 (10)	-	2.9	0.29

11. User interface	*User interface*	19 (90)	2 (10)	-	2.9	0.29
12. Data cleansing	*Use of software*	20 (95)	1 (5)	-	2.95	0.21
13. Use of DIQ enabling tools	*Use of DIQ tools*	19 (90)	2 (10)	-	2.9	0.29
14. Data gap between asset maker/provider and asset user	*Data gap between the maker and user of asset*	20 (95)	1 (5)	-	2.95	0.21
	Conditional provision of information	20 (95)	1 (5)	-	2.95	0.21
15. Automated data/information capture		19 (90)	2 (10)	-	2.9	0.29
16. DIQ monitoring	*Monitoring systems*	19 (90)	2 (10)	-	2.9	0.29
17. DIQ verification	*System standardization*	21 (100)	-	-	3.0	0

16 dan 17 disatukan pada Ronde III atas permintaan Respondent

Masalah dan Faktor Penyebab Masalah KDI (Perspektif Organisasi)

Delphi Ronde II (N=20)						
Masalah Organisasi KDI	**Faktor Penyebab**	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. Cross-Study Programs management communication	*Communication/ collaboration*	20 (95)	1 (5)	-	2.95	0.21
2. Appropriate coordination mechanism of the team	*Direct link priority*	21 (100)	-	-	3.0	0
	Regular meeting	20 (95)	1 (5)	-	2.95	0.21
3. Data input control	*Data input control*	21 (100)	-	-	3.0	0
4. Disparate data/information sources	*Integration of disparate information sources*	19 (90)	2 (10)	-	2.9	0.29
	Use of verbal information	19 (90)	2 (10)	-	2.9	0.29
5. Clear data/information vision (DIQ strategy-Institution objective)	*Academic process flow*	21 (100)	-	-	3.0	0
	Operational merit	21 (100)	-	-	3.0	0
	Quality assurance	21 (100)	-	-	3.0	0
6. Data integration	*Data integration*	21 (100)	-	-	3.0	0
7. Use of data	*Data use for academic (LMS)*	20 (95)	1 (5)	-	2.95	0.21
	Treatment of LMS	19 (90)	2 (10)	-	2.9	0.29
8. Awareness of organizational of new academic information systems	*New skills requirements*	20 (95)	1 (5)	-	2.95	0.21
	Role change	20 (95)	1 (5)	-	2.95	0.21
	University/institution organization structure	20 (95)	1 (5)	-	2.95	0.21
9. Large volumes of data (big data)	*Collection of big data*	19 (90)	2 (10)	-	2.9	0.29
	Analysis of big data					
	Distribution	19 (90)	2 (10)	-	2.9	0.29
10. Institutional structure		18 (85)	3 (15)	-	2.86	0.35
11. IT Governance	*Data transparency*	21 (100)	-	-	3.0	0
12. Manual/paper based data acquisition	*Manual/paper-based data collection & entry*	21 (100)	-	-	3.0	0
	Data capture process	21 (100)	-	-	3.0	0

13. Information supplier's quality management	*Information supply from suppliers*	19 (90)	2 (10)	-	2.9	0.29
14. Information need analysis	*Identification of needs for data/information*	19 (90)	2 (10)	-	2.9	0.29
15. Unfocus data collection	*Planning*					
	Guidance	20 (95)	1 (5)	-	2.95	0.21
16. Data access and coordination access across Schools/Department/Study Programs	*Coordination od data/information*	21 (100)	-	-	3.0	0
17. Commitment of senior management	*Dean, Rector (and others First level management) commitment*	19 (90)	2 (10)	-	2.9	0.29
18. Process evaluation, review/audit	*Business process review*	20 (95)	1 (5)	-	2.95	0.21
19. DIQ policies and support	*Staff/lecturer support*	19 (90)	2 (10)	-	2.9	0.29
	System support	20 (95)	1 (5)	-	2.95	0.21

7 dan 14 disatukan pada Ronde III atas permintaan Respondent
12 dan 13 disatukan pada Ronde III atas permintaan Respondent

Masalah dan Faktor Penyebab Masalah KDI (Perspektif Pengguna/Individu)

Delphi Ronde II (N=20)						
Masalah Pengguna KDI	**Faktor Penyebab**	Agree=3 Frekuensi (%)	Neutral=2 Frekuensi (%)	Disagree=1 Frekuensi (%)	Mean	SD
1. Informal social communication between personnel	*Communication, friendship*	19 (90)	2 (10)	-	2.9	0.29
2. Craft skill and training	*Education and specific training*	21 (100)	-	-	3.0	0
3. Personal competency and experience	*Recruitment pattern*	20 (95)	1 (5)	-	2.95	0.21
4. Data stewardship	*Data stewardship*	21 (100)	-	-	3.0	0
5. Disconnect among data stakeholders	*Awareness of importance of data production*	21 (100)	-	-	3.0	0
	Knowledge gap between data collector and data entry staff (in SP or Department/School)	21 (100)	-	-	3.0	0
6. Teamwork	*Awareness, mutual advantages working in team and individual*	21 (100)	-	-	3.0	0
7. Performance evaluation and motivation	*Self motivation for data/information collection*	21 (100)	-	-	3.0	0

1 dan 6 disatukan pada Ronde III atas permintaan Respondent

Bagaimana mengidentifikasi dan memperbaiki kualitas data dan informasi Pendidikan Tinggi
Kalimat telah direvisi berdasarkan saran dan perbaikan dari beberapa panelis, sebagai berikut:

Identified some of the most common issues with data. Data resides in silos, as do inefficient, manual data entry processes that are slow and error-prone. Data management roles aren't clearly defined, and there's a lack of communication between departments. All of these problems contribute to inaccuracy in data and an inability to properly monitor data as well as information for quality.

In higher education, data quality issues are similar. They typically involve incomplete and out-dated information, which often exists in silos. There is a lack of ownership and responsibility of data, especially in study program level. This can result in operational inefficiency, the inability to understand and improve the student experience, and failure to identify at-risk students and offer the appropriate assistance.

An effective data quality strategy begins with collaboration between data creators and end-users to pinpoint the root cause of quality issues. This way, these problems **can be fixed** when data is created rather than forcing assigned staff (IT people) to correct or work around bad data. Instead of focusing on cleaning up existing data, HE Institutions should work to improve the quality of new data at the point of creation, which will limit how often data clean-ups are required. Finally, DIQ problems shouldn't be dumped on IT's plate. IT sees little benefit from good data and little pain from bad data. Data should be the responsibility of creators, who benefit the most from having access to quality data/information.

Aggregating all data into a centralized system. Regardless of source, data is integrated and validated while sophisticated matching algorithms eliminate duplicate records. All data can then be managed through a simple, intuitive interface, or send it to the cloud whenever needed.

Kriterea Seleksi Paket Sofware/Aplikasi KDI

Delphi Ronde II (N=20)						
Selection area	**Selected selection categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Functional Features	• Shared space with media rich content	19 (90)	2 (10)	-	2.9	0.29
	• Access to portable devices	21 (100)	-	-	3.0	0
	• Cloud oriented	20 (95)	1 (5)	-	2.95	0.21
	• Integration for information exchange	19 (90)	2 (10)	-	2.9	0.29
	• Ability to harvest data from multiple sources	21 (100)	-	-	3.0	0
	• Customisable with several configuration options for the administrator, while hiding complexity for the user	20 (95)	1 (5)	-	2.95	0.21
	• Allowing scribbling on the screen	19 (90)	1 (5)	1 (5)	2.9	0.51
	• Backlog-work orders planned and prioritized, waiting scheduling and execution to support IT crew.	20 (95)	1 (5)	-	2.95	0.21
	• Q & A platform forum	21 (100)	-	-	3.0	0
	• Audio and video teleconferencing capabilities	21 (100)	-	-	3.0	0
	• Predictive and preventive maintenance scheduling	20 (95)	1 (5)	-	2.95	0.21
	• Shared note taking application	21 (100)	-	-	3.0	0
	• Stock inventory for university asset management	21 (100)	-	-	3.0	0

	• Deployment easy	21 (100)	-	-	3.0	0
	• Support email and SMS alert for high and medium priority	21 (100)	-	-	3.0	0
	• Able to mark up entire job plan	20 (95)	1 (5)	-	2.95	0.21

Kriterea Seleksi Paket Sofware/Aplikasi KDI

Delphi Ronde II (N=20)						
Selection area	**Selected selection categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Non Functional Features	• Scalable architecture	21 (100)	-	-	3.0	0
	• Facilitating interfaces development to other software (technical & cost-wise)	20 (95)	1 (5)	-	2.95	0.21
	• Support for mobile devices	21 (100)	-	-	3.0	0
	• Usability: intuitiveness of user-friendly interfaces	20 (95)	1 (5)	-	2.95	0.21
	• Reliability/fault tolerance: in term of data security and integrity	20 (95)	1 (5)	-	2.95	0.21
	• Synchronous/asynchronous (online/offline) seamless operation	21 (100)	-	-	3.0	0
	• Report generation supporting different file formats	21 (100)	-	-	3.0	0
	• The device's size is suitable for field site/light weight	21 (100)	-	-	3.0	0
	• Real-time capability	21 (100)	-	-	3.0	0
	• Software workflow flexible to academic business process change & update	21 (100)	-	-	3.0	0
	• Key performance indicator (KPI) support	20 (95)	1 (5)	-	2.95	0.21
	• Long-time battery life	21 (100)	-	-	3.0	0

Kriterea Seleksi Paket Sofware/Aplikasi KDI

Delphi Ronde II (N=20)						
Selection area	**Selected selection categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Commercial aspects	• Compatibility/interoperable with others non academic information systems package	18 (85)	2 (10)	1 (5)	2.8	0.51
	• Install platform/market share*	2 (10)	1 (5)	18 (85)	1.3	0.73
	• Match to the University's business activities	18 (85)	2 (10)	1 (5)	2.8	0.51

* Dicapai Konsesnsus Tidak Setuju

Peran Teknologi Komunikasi Bergerak yang Diharapkan pada Perbaikan KDI Pendidikan Tinggi

Delphi Ronde II (N=20)						
Area	**Feature category**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree= 1 Frekuensi (%)**	**Mean**	**SD**
Flexibility (initiate application at flexible sites in unstructured networked)	• Visualising of collected data, parameter history and trending.	21 (100)	-	-	3.0	0
	• Contextualising access over remote data and services: task-related services and data entry ubitously available to authorised users/university members (active students, staffs, lectures).	21 (100)	-	-	3.0	0
	• Critical for response time for data or information that can lead to early correction and or identification of failures.	21 (100)	-	-	3.0	0
	• Providing the notification of failure through mobile devices	21 (100)	-	-	3.0	0
	• Detecting the location of skilled IT personel nearby Studi Program that has experienced a failure through GPS (for Help Desk purposes).	21 (100)	-	-	3.0	0
	• Mobile technology allows at the right place to access directly to a set of information in the form of learning materials (online, share courseware and share content),	21 (100)	-	-	3.0	0

Peran Teknologi Komunikasi Bergerak yang Diharapkan pada Perbaikan KDI Pendidikan Tinggi

Delphi Ronde II (N=20)						
Area	**Feature category**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Empowering management	• Resources management (learning material, lecturer) facilitator for continous task monitoring/assignment/ evaluating/reporting.	21 (100)	-	-	3.0	0
	• Building and identifying process verification tasks, approvals.	21 (100)	-	-	3.0	0
	• It helps to report failure effectively and report university members actual working hours and availability.	21 (100)	-	-	3.0	0
	• Allowing to take the right	21	-	-	3.0	0

	administrative/academic/research decision, at the right time, at the right place, from the right information.	(100)				
	• Enhancing accuracy of critical data entry for student/lecture history.	21 (100)	-	-	3.0	0
	• Holiday (not in office) notifications and live feeds.	18 (85)	1 (5)	2 (10)	2.76	0.62
	• Q/A decisions	19 (90)	2 (10)	-	2.9	0.29

Peran Teknologi Komunikasi Bergerak yang Diharapkan pada Perbaikan KDI Pendidikan Tinggi

Delphi Ronde II (N=20)						
Area	**Feature category**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Others	• In the technology adoption lifecycle I'd say it's at the "moment of adopters" stage. Somehow there are big expectations on the role of mobile technology, and I think we're approaching the "peak of inflated expectations".	20 (95)	1 (5)	-	2.95	0.21
	• I have seen it in action and it is a must in today's HE development from time keeping for online learning or at least blended learning context.	21 (100)	-	-	3.0	0
	• In developing countries this is limited use at the moment, still structured and static approach.	19 (90)	1 (5)	1 (5)	2.9	0.48
	• It is still very limited as HE institution don't tend to invest in such luxury features. Eventhough current mobile solutions are relatively mature enough in academic context.	19 (90)	2 (10)	-	2.9	0.29

Manfaat Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Benefit area	**Selected benefit categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Networking/ Communication	• Reduce of waste (time, task overlap, task complimentarity) due to better communication	21 (100)	-	-	3.0	0
	• Information/data triangulation (coupling of different University stakeholder's views/undrstandings), self-institution and emerging	21 (100)	-	-	3.0	0

	approaches for conducting the academic tasks in opposition to imposed and rigid manners to develop University.					
	• It is a relevant item in the way to be able to take the right academic/administrative/management related decision, at the right time, at the right place, from the right information.	21 (100)	-	-	3.0	0
	• Direct data/information (new and revsed version) input from anywhere might allow someone having to enter the information and possible collaborative work with others	21 (100)	-	-	3.0	0
	• Remote reviewing of feedback by a supervisor-student	21 (100)	-	-	3.0	0
	• Track inventories in realtime.	21 (100)	-	-	3.0	0

Manfaat Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Benefit area	**Selected benefit categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Coordination	• Scale responsiveness and Study Program coordination	21 (100)	-	-	3.0	0
	• Ability to develop a complete learning/research strategy that includes planning and unplanning academic tasks.	21 (100)	-	-	3.0	0
	• More eyes over shared items leads to better potentials to identify weak points and problems	21 (100)	-	-	3.0	0
	• Improved coordination and cooperation between lecturer-staff in term of academic quality assurance on the fly.	21 (100)	-	-	3.0	0
	• Effectively deploy available learning resources (class, skills and laboratory support equipment)	21 (100)	-	-	3.0	0

Manfaat Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Benefit area	**Selected benefit categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Cooperation	• Build a better understanding for responsibilities and hierarchy	21 (100)	-	-	3.0	0
	• Faster and more effective performance enhancement action plan implementation throughout the university.	21 (100)	-	-	3.0	0
	• Increased sense of confidence as university members would feel continuously members of an overall team that is always available to support them, while they build their own contribution	21 (100)	-	-	3.0	0
	• Establishing a shared and commonly perceived institutional culture: supervising young staff/lecture would be able to participate and oversee the collaborating environment; interacting at peer level, having team-wide scope and goals in their academic actions	21 (100)	-	-	3.0	0
	• Standardisation of learning process and evaluation (including online quiz), language, approach, solutions.	20 (95)	1 (5)	-	2.95	0.21
	• Cumulative learning-increase learning curve	20 (95)	1 (5)	-	2.95	0.21

Manfaat Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Benefit area	**Selected benefit categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Productivity	• Sustainability – the system will remain running even if one person leave	21 (100)	-	-	3.0	0
	• Provides the intelegent repository of data/information. Historical data/information can be used to enhance the University plans, Performance Indicator	21 (100)	-	-	3.0	0

	(PI) and support better decesion making.					
	• Improved craft University productivity.	21 (100)	-	-	3.0	0
	• More planned work leading to greater uptime and Overall Effectiveness (OEE)	20 (95)	1 (5)	-	2.95	0.21
	• Increased capacity, throughput and World Class achievement	21 (100)	-	-	3.0	0
	• Real-time information enabling right and quick decision making	21 (100)	-	-	3.0	0
	• Greater probability of achieving THE GOAL-Total acdemic Success	21 (100)	-	-	3.0	0
	• Visibility to problems	21 (100)	-	-	3.0	0
	• Increase staff/lecture productivity	19 (90)	2 (10)	-	2.9	0.29
	• Increase transperency (IT Government)	21 (100)	-	-	3.0	0
	• Help Study Program/Departments to reduce costly downtime-control expenses	20 (95)	1 (5)	-	2.95	0.21
	• Log and record personnel performance as University group members (stakeholders)	21 (100)	-	-	3.0	0

Faktor yang Bisa Menghambat Implementasi Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Area	**Typical issue categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Mobile collaborative technology readiness	• The role of technology to facilitate collaborative learning is moderate significantly by Human Computer Interface factor.	17 (80)	2 (10)	2 (10)	2.7	0.6
	• Technology does not operate as expected in real world, energy is still an open problem for many contexts; e.g., remote campus (class) has to be adapted to batteries availability/charge.	19 (90)	1 (5)	1 (5)	2.9	0.48
	• Security becomes even more important and complex.	21 (100)	-	-	3.0	0

Faktor yang Bisa Menghambat Implementasi Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Area	**Typical issue categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Collaborative learning readiness	• Establishing common ground is a crucial activity for collaboration in learning context	20 (95)	1 (5)	-	2.95	0.21
	• Competing objectives or interest within the group (students and lectures)	20 (95)	1 (5)	-	2.95	0.21
	• Competing requirements of time if group is not dedicated to collaborative learning	20 (95)	1 (5)	-	2.95	0.21
	• Lack of support from University First Level Management	21 (100)	-	-	3.0	0
	• Too much sharing of specific assignement/quiz/homework in collaboration may make it hard to make it consistent and finalise (marking) it.	21 (100)	-	-	3.0	0
	• Shared response with collaboration may lead to decentralisation of true responsibility over decisions and actions.	21 (100)	-	-	3.0	0

Faktor yang Bisa Menghambat Implementasi Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Area	**Typical issue categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
People and Culture	• Lack of knowledge of todays best practices by top University/School/Study Program leaders.	19 (90)	1 (5)	1 (5)	2.9	0.48
	• Approriate expertise on both sides (industry/provider and academia)	20 (95)	1 (5)	-	2.95	0.21
	• Availability and	21 (100)	-	-	3.0	0

	responsiveness of skilled personnel					
	• Culture – sharing of academic information and data and collaborating in a University can generate big problems between thestudets because of the inertia of their backgrounds	20 (95)	1 (5)	-	2.95	0.21
	• Lack of commitment of resources	19 (90)	2 (10)	-	2.9	0.29
	• Individual task possibly conflict with other planned or regular assignments from different courses.	20 (95)	1 (5)	-	2.95	0.21
	• Negative reactions of the students due to "technological shock" and the perception that it will increase workload	20 (95)	1 (5)	-	2.95	0.21
	• Misuse of the system – degrading to a simple chatting and irrelevant file sharing tool	20 (95)	1 (5)	-	2.95	0.21
	• Recording and monitoring of performance at all levels may cause anxiety to supervised students.	20 (95)	1 (5)	-	2.95	0.21

Faktor yang Bisa Menghambat Implementasi Pembelajaran Collaborative berbasis Sistem Komunikasi Bergerak

Delphi Ronde II (N=20)						
Area	**Typical issue categories**	**Agree=3 Frekuensi (%)**	**Unsure=2 Frekuensi (%)**	**Disagree=1 Frekuensi (%)**	**Mean**	**SD**
Economical aspect	Funding	21 (100)	-	-	3.0	0

Istilah Kualitas Data dan Kualitas Informasi dapat digunakan secara bergantian dengan makna yang sama

Delphi Ronde II (N=20)				
Issue	**Agree = 2 Frekuensi (%)**	**Disagree = 1 Frekuensi (%)**	**Mean**	**SD**
Data Quality could be used interchangeable (has the same meaning) with Information quality	21(100)	-	2	0

Lampiran 2:

Analisis Statistik Ronde ketiga

Technology Requirements	Respon	Mean Rank	SD	Min Value	Max Value	Ranking Order
1. System integration	20	3.22	2.88	1	6	1
2. Configurability-Deployment	20	3.56	2.36	1	6	2
3. Database synchronisation	20	4.22	3.28	1	7	3
4. System adoption, implementation and documentation	20	5.17	1.58	2	7	4
5. DIQ monitoring/Verification	20	5.33	2.74	2	8	5
6. Mobility-Data and services through contextualized and mobile interface	20	6.00	3.03	2	9	6
7. Data and services functionality porting to the cloud	20	6.22	2.82	3	10	7
8. Use of DIQ enabling tools	20	6.33	2.06	4	10	8
9. Support of computing infrastructure resources	20	6.83	2.28	4	11	9
10. Data gap between asset maker/provider and asset user	20	8.11	2.03	5	11	10
11. User interface	20	8.56	3.33	6	12	11
12. Systematic asset description	20	9.11	3.72	7	14	12
13. Capability constraint of system	20	10.18	3.8	8	15	13
14. Data cleansing	20	10.41	2.56	10	14	14
15. Automated data/information capture	20	10.55	4.05	11	16	15
16. Autonomous information/communication exchange	20	11.24	3.17	13	16	16
Total						

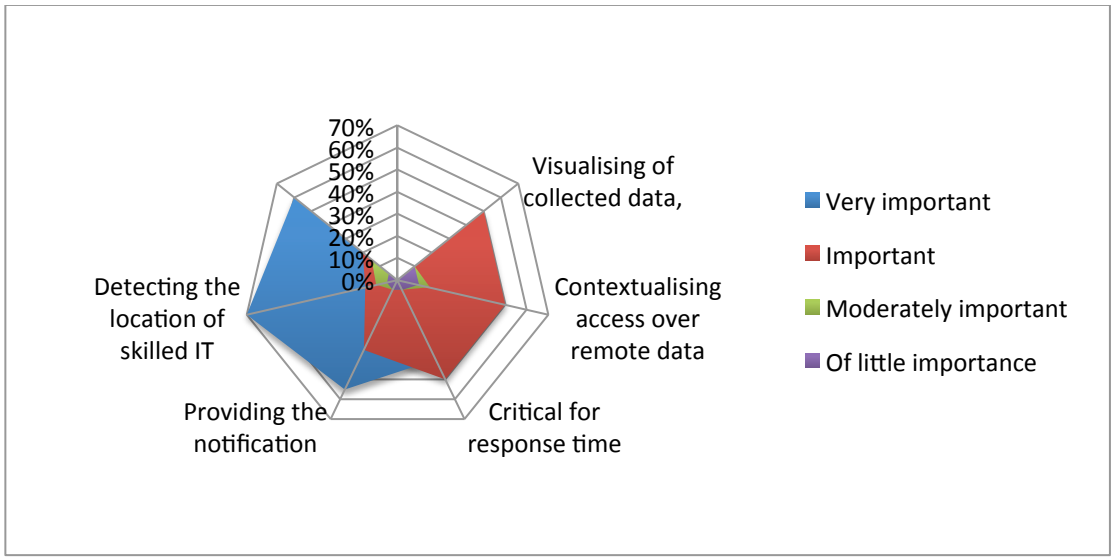
Lampiran 2:

Organisational Requirements	Respon	Mean Rank	SD	Min Value	Max Value	Ranking Order
1. Clear data/information vision (DIQ strategy-HE Institution leadership)	20	2.06	1.43	1	5	1
2. IT (Data) Governance	20	3.50	1.79	1	6	2
3. Manual/paper based data acquisition	20	3.83	2.93	1	8	3
4. Data access and coordination access across Schools/Department/Study Programs	20	4.78	2.13	2	8	4
5. Data integration	20	5.00	2.72	2	10	5
6. Cross- Study Programs management communication	20	5.44	2.15	3	10	6
7. Large volumes of data (big data)	20	6.33	2.22	3	9	7
8. Awareness of organizational implication of new academic information systems	20	6.44	1.72	4	10	8
9. Un-Planned/Use of data	20	6.53	1.28	6	10	9
10. DIQ policies and support	20	7.22	1.48	4	10	10
11. Commitment of senior management	20	7.45	2.08	7	12	11
12. Information need analysis	20	7.77	3.22	7	14	12
13. Appropriate coordination mechanism of the team	20	7.92	2.97	10	15	13
14. Data input control	20	8.33	2.28	8	16	14
15. Disparate data/information sources	20	9.22	2.11	9	16	15
16. Process evaluation, review/audit	20	10.11	1.77	11	16	16
Total						

Personal Requirements	Responses	Mean Rank	SD	Min Value	Max Value	Ranking Order
1. Craft skill and training	20	1.61	0.78	1	3	1
2. Personal competency and experience	20	3.00	1.68	1	6	2
3. Teamwork and Informal social communication between personnel	20	3.22	1.26	1	5	3
4. Data stewardship	20	3.33	1.19	1	5	4
5. Disconnect among data stakeholders	20	3.89	1.18	2	5	5
6. Performance evaluation and motivation	20	5.94	0.24	5	6	6
Total						

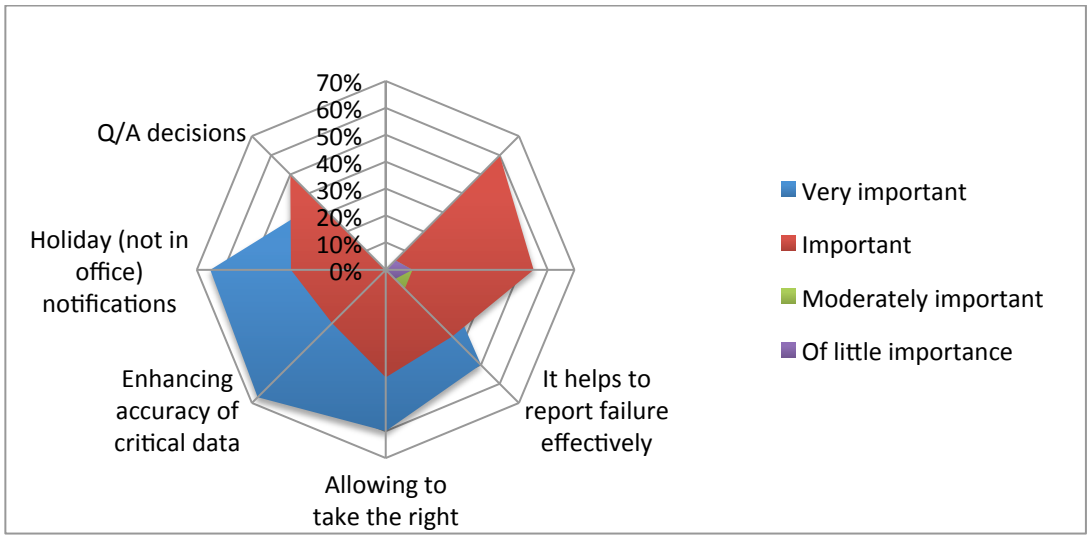
Lampiran 2:

Flexibility (initiate application at flexible sites in unstructured networked)	Very important	Important	Moderately important	Of little importance	Not important
Visualising of collected data,	30%	50%	10%	10%	0%
Contextualising access over remote data	25%	50%	15%	10%	0%
Critical for response time	40%	50%	5%	5%	0%
Providing the notification	55%	35%	5%	5%	0%
Detecting the location of skilled IT	70%	15%	10%	5%	0%
Mobile technology allows at the right	60%	20%	15%	5%	0%



Empowering Management	Very important	Important	Moderately important	Of little importance	Not important
Resources management (learning material, lecturer)	30%	60%	5%	5%	0%
Building and identifying process verification	20%	55%	10%	10%	0%
It helps to report failure effectively	50%	35%	10%	5%	0%
Allowing to take the right administrative	60%	40%	0%	0%	0%
Enhancing accuracy of critical data	67%	28%	5%	0%	0%
Holiday (not in office) notifications	65%	35%	0%	0%	0%
Q/A decisions	35%	50%	15%	0%	0%

Lampiran 2:



Others	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
it's at the "moment of adopters" stage.	37%	42%	11%	10%	0%
It is a must in today's HE development	30%	55%	10%	5%	0%
In developing countries this is limited use	60%	40%	0%	0%	0%
HE institution don't tend to invest in such luxury features.	75%	5%	10%	10%	0%